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**POWER GENERATION RESOURCE INCENTIVES
AND DIVERSITY**

**HEARING
BEFORE THE
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
ONE HUNDRED NINTH CONGRESS
FIRST SESSION**

TO

RECEIVE TESTIMONY REGARDING WAYS TO ENCOURAGE THE
DIVERSIFICATION OF POWER GENERATION RESOURCES

MARCH 8, 2005



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POWER GENERATION RESOURCE INCENTIVES AND DIVERSITY

TUESDAY, MARCH 8, 2005

**U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.**

The committee met, pursuant to notice, at 2:35 p.m. in room SD-366, Dirksen Senate Office Building, Hon. Pete V. Domenici, chairman, presiding.

OPENING STATEMENT OF HON. PETE V. DOMENICI, U.S. SENATOR FROM NEW MEXICO

The CHAIRMAN. First, let me thank you all for coming, and indicate that Senator Bingaman has long been an advocate of a Federally-mandated renewable portfolio standard that requires that retail suppliers obtain up to 10 percent of electricity from renewable resources, like wind, solar, geothermal, and traditional renewables. While that kind of RPS has received over 50 votes in the Senate in the past, the House has never been willing to accept that.

Assistant Secretary Garman's written testimony makes it clear that the administration would not favor that specific kind of standard. Some have billed the RPS hearing—this as an RPS hearing, but I want to make it clear that we're here to talk, not exclusively about wind, hydropower, solar, and other traditional renewable energies, we're here to review the benefits and costs of renewable RPS programs, discuss State efforts, and, most importantly, to explore this question: Should Congress go beyond R&D and tax credit programs and begin to mandate the use of certain types of fuel for electricity generation in order to ensure diversification?

Full diversification is—or fuel diversification is a very key and important issue, as Mr. Brunetti, who is here, notes in his written testimony. Any Federal generation diversity program needs to include more than just traditional renewable energy sources. That's essentially your position. You'll discuss it in far more detail. It should also include a variety of clean alternatives; at least that's the position that's being taken by one part of the industry.

In addition to focusing on fuel diversity, I think we have to also consider the unique characteristics of each State. And someone will talk about that today, too.

I would summarize by saying there are 19 States today, including my home State of New Mexico, and Senator Bingaman's, that have their own individual specially tailored versions of a portfolio program.

Mr. Bowers, from Southern Company, makes the case that, because wind resources are limited, costly, and not of sufficient quality in the Southeast, a mandate that heavily favors wind would harm customers in that region, as I understand the testimony today. Senator Bingaman and others might talk about how that could be avoided or how that might be melded into something else.

A Federal program that would force ratepayers in one region to subsidize specially favored resources from another region would seem to be very difficult to accept.

Senator Bingaman, I read about a page of my observations, and—

What is an acceptable program that balances the goals—fuel diversification and some kind of reality about States or States' rights—as part of the effort to develop an energy bill? I hope that Senator Bingaman and I, as well as other members, can make a good faith effort to work together on RPS. A national generation resource diversity standard should go beyond a subset of traditional renewables, and aim at capturing the benefits, as I see it, of fuel diversification, technology development, climate change, and other things.

Now, the witnesses that have been invited today represent a variety of views. They advocate a range of ideas, from how best to encourage the use of traditional renewables, to how to encourage alternative clean sources, like advanced coal and nuclear technology. And I want to thank, again, each of you for the work you've done in preparing for this.

And I want to thank Assistant Secretary Garman. Your nomination to DOE Under Secretary, by President Bush, reflects the confidence we all share in your abilities and your known character.

So, I look forward to your comments. With that, I would yield to my Ranking Member, and then we'll proceed in an orderly manner so we can get everybody in this afternoon.

Senator Bingaman.

**STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR
FROM NEW MEXICO**

Senator BINGAMAN. Well, thank you very much, Mr. Chairman. Thanks for having this hearing. I think this is a very important issue.

As you know, I have supported passing legislation to establish a renewable portfolio standard now for the last couple of Congresses. I believe it's an important part of a national comprehensive energy policy.

I also believe—and I'm sure you do, too—that we should extend the production tax credit for renewables for at least another 5 years, if not 10 years, so that we can provide some stability in that area for companies that are making investments.

The proposal we had in the previous Congress, of course, was to require 10 percent of electricity to be supplied from renewable resources by 2020. That is, in my view, an achievable objective, it's not an overly ambitious objective, and one that we ought to go back to. We have a lot of experience, because of the work that's occurred in many States, on how to structure renewable portfolio standard legislation. And we have strong support for doing something like

this from consumer groups, from labor organizations, from trade associations, from utilities, from state and local authorities, environmentalists. A great many groups have expressed an interest in seeing something done along this line.

I am interested in hearing from the witnesses on your suggestion about encouraging other generation sources, such nuclear power and Integrated Gasification Combined Cycle coal plants. I think we need to understand how that might work. And hopefully this set of witnesses can give us some insights.

Thank you.

The CHAIRMAN. Thank you very much, Senator.

I note that Senator Salazar has entered. Would you like to comment before we start, Senator Salazar?

Senator SALAZAR. I'll follow the Domenici rule and just say I have a statement for the record.

[The prepared statement of Senator Salazar follows:]

PREPARED STATEMENT OF HON. KEN SALAZAR, U.S. SENATOR FROM COLORADO

Thank you, Mr. Chairman. I'd like to extend a welcome to all the members of the two witness panels that are here today. Thank you for taking time out of your schedules to help this committee as we look for ways to secure America's energy future—including a robust Renewable Portfolio Standard (RPS).

As the members of this panel are aware, Colorado is one of several states that have already instituted an RPS. Our target is to generate 10% of Colorado's energy demands using renewable sources by 2015. I believe this is a reasonable goal: one that encourages investment in renewable energy, yet does not place a detrimental burden on industry or on consumers. In Colorado and across the country, we expect that more investment in renewable energy sources will reduce capital costs while increasing the efficiency of the generating systems. We also fully expect that investment in renewable energy technologies will lead to job creation and economic growth.

I would like to specifically address the nation's capacity to add to its renewable portfolio by increasing investments in both wind and biomass energy. The potential amount of power that could be produced by those sources is tremendous, and research and development of these technologies is key to our energy future. The National Renewable Energy Laboratory in Colorado is an invaluable contributor to research in both of these areas. As for solar power, NREL has begun construction on a state of the art photovoltaic laboratory. A good RPS will use a wide variety of renewable energy sources; no single technology will do the trick.

Finally, I want to point out that there is another aspect to balancing our power demands that does not receive enough attention. Energy efficiency needs to play a greater role in our future. Reductions in power demands can be achieved across a wide spectrum of applications, from cell phone chargers to the design of office buildings. Gains in efficiency have the same net result as an increase in renewable energy: with no new pollutants or emissions, more power is available.

I look forward to our discussion.

The CHAIRMAN. Thank you very much.

Okay, now we're going to start over here on the left with the Secretary, and move across. Shall we start with 5 minutes each, with your statements already being made a part of the record? We do that right now. So let's proceed.

David, you go ahead.

STATEMENT OF DAVID GARMAN, ASSISTANT SECRETARY FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY

Mr. GARMAN. Thank you, Mr. Chairman and members of the committee. I appreciate this opportunity to testify today on general portfolio standards.

I have in the audience with me the Deputy Administrator of the Energy Information Administration, Howard Gruenspecht, in the event that questions pertaining to prior EIA analyses of this subject come up.

As the chart beside me illustrates, 50 percent of our electricity is generated using coal, 20 percent is generated using nuclear power, 18 percent using natural gas, 9 percent using renewable energy, and 2 percent generated using oil. Portfolio standards have often been discussed as a way to alter that generation mix in pursuit of certain public goals.

The administration, however, opposes a universally applied, Federally-mandated renewable portfolio standard. Indeed, we do not presently support a Federal power generation portfolio standard of any kind. We're mindful that past government attempts to alter the electricity generation mix have brought unforeseen consequences. One example is the Fuel Use Act, passed in 1978 and repealed in 1987, that curtailed the use of natural gas for electricity generation.

We do, however, support narrower market interventions in the form of renewable energy production tax credits, a personal tax credit for the installation of residential solar, and investment tax credit for certain combined heat and power applications, and modification of the tax treatment for nuclear decommissioning funds.

While we oppose a national RPS, we have not opposed efforts by States to adopt renewable portfolio standards. We believe that States are the best equipped to develop portfolio standards that fit their situation and their available resources. After all, power generation options and resources vary widely from State to State, States hold different views of the different types of resources they would like to support, and retail electricity sales are regulated largely at the State level.

A national renewable energy portfolio standard, on the other hand, could create winners and losers among regions of the country; the winners generally being the regions with ample renewable resources, and the losers being the regions without. Moreover, a national RPS could lead to higher energy bills and opposition to renewable energy in areas where the resources are less abundant and harder to cultivate or distribute.

About a third of the States have enacted mandatory renewable portfolio standards. These standards already apply to about 35 percent of the total U.S. electricity load. And though the policies are still young, they're beginning to drive the development of the renewable energy marketplace at a healthy pace.

The President's own State of Texas is at the forefront of successful State renewables portfolio standards. Signed into law when President Bush was then the Governor, the Texas RPS requires that electricity suppliers in Texas purchase renewable energy, and those suppliers have primarily opted to tap the plentiful wind resources in the western part of the State. Texas, as a consequence, is now the second-largest generator of wind electricity in the country, with 1293 megawatts of installed wind capacity at the end of 2004.

However, State experiences in setting and implementing the renewable portfolio standards also suggest that we need to be cau-

tions on how we use regulations to stimulate renewable energy markets. As one example, an RPS will not increase renewable energy supply at reasonable cost if the supply/demand balance is not carefully managed. If the RPS is too aggressive, supply constraints and high costs may result. These and other challenges have confronted many States in the design and implementation of their RPS policies. And not all of these RPS policies are operating smoothly. Again, we believe that Governors, State legislatures, energy companies, and other regional stakeholders are in the best position to develop a portfolio standard that will meet their State's energy, environmental, and economic needs while responding to the challenging task of effectively implementing an RPS.

I want to close my statement by noting that, while there are a number of policies and programs in place today to bring renewables into the mainstream, the most encouraging sign to me is that many renewable projects are being pursued because they're money-making options for investors. This is largely due to the technological advances that have occurred through the years of sustained Federal and private sector investment in renewable energy research and development.

That completes my prepared statement. I'll be happy to answer any questions the Committee may have, either now or in the future.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Garman follows:]

PREPARED STATEMENT OF DAVID GARMAN, ASSISTANT SECRETARY FOR ENERGY
EFFICIENCY AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY

Mr. Chairman and Members of the Committee, I appreciate the opportunity to testify today on electricity generation portfolio standards.

Today, electricity in the United States is generated using a mix of coal (50%), nuclear power (20%), natural gas (18%), renewable energy (9%—mostly hydropower), and oil (2%). Portfolio standards have been discussed as a way to alter the generation mix in pursuit of certain public goals and benefits, and we welcome the opportunity to discuss the use of portfolio standards as a policy tool.

The Federal Government has in the past intervened to alter the electricity generation mix, most notably with the passage in 1978 of the Fuel Use Act which effectively curtailed the use of natural gas for electricity generation. At the time of the Act's enactment, coal generated about 985 billion kilowatt hours of electricity in the United States, while natural gas generated about 305 billion kilowatt hours. By 1988, partially as a consequence of the Act, natural gas generation had fallen by 17 percent to 253 billion kilowatt hours, as coal-fired generation had risen by 56 percent to 1540 billion kilowatt hours. Since the repeal of the Fuel Use Act in 1987, natural gas generation has nearly tripled to over 690 billion kilowatt hours¹, but the fleet of coal-fired plants put into service from 1970 through the mid-1980s has remained the backbone of our electricity generation capacity. Clearly, Federal interventions in the marketplace can have significant, long-lasting and, unfortunately, sometimes unanticipated negative impacts.

The Administration opposes a national renewable portfolio standard (RPS). Because power generation options and renewable resources vary widely from state to state, because states hold different views of the types of resources that they would like to support, and because retail electricity sales are regulated largely at the state level, we believe that states are best equipped to develop portfolio standards that fit their situation and available resources. A national RPS, on the other hand, could create "winners" and "losers" among regions of the country the winners generally being the regions with ample renewable resources, and the losers being the regions without. Moreover, a national RPS could lead to higher energy bills and opposition to renewable energy in areas where these resources are less abundant and harder to cultivate or distribute. In the end, this may be counter-productive to renewable

¹ Energy Information Administration, 2002 figures.

energy moving into the mainstream of the Nation's energy supply mix. We do, however, support narrower market interventions in the form of a renewable electricity production tax credit; a personal tax credit for the installation of residential solar; an investment credit for certain combined heat and power applications; and modifications of the tax treatment of nuclear decommissioning funds.

Although the Administration opposes a national RPS, we have not opposed efforts by states to adopt RPS programs at the state level. About a third of the states have enacted mandatory renewables portfolio standards (18 States plus the District of Columbia). These standards already apply to approximately 35 percent of the total U.S. electricity load, and though the policies are still young, they are beginning to drive the development of the renewable energy marketplace at a healthy pace. For example, the EIA has estimated that the development of more than 2,000 megawatts (MW) of renewable energy has been motivated, at least in part, by state RPS policies and other purchase mandates. More importantly, private research companies estimate that on balance, two-thirds of new renewable energy capacity additions will occur in RPS-States,² and Ryan Wiser of the Lawrence Berkeley National Lab, one of the witnesses on our panel this morning, has estimated that nearly 50% of U.S. wind additions over the last four years have been motivated, in part, by state RPS policies. An estimated \$30-\$50 billion in capital will be necessary over the next decade to meet the requirements of state RPSs, assuming full RPS compliance. Separate forecasts estimate that current state portfolio standards, if implemented in full, will result in new renewable energy capacity additions of over 20,000 megawatts by 2017. To put these numbers in context, the Nation's non-hydro renewable electricity generation capacity will more than double over the next twelve years due to state renewable portfolio standards, rising from about 15,000 megawatts today to over 35,000 megawatts in 2017. Much of the new capacity is likely to be fueled by wind power, with smaller amounts of landfill gas, hydroelectricity, biomass, geothermal, and solar photovoltaic technologies.

The President's own State of Texas is at the forefront of successful state renewables portfolio standards. Signed into law when President Bush was governor, the Texas RPS requires that electricity suppliers in Texas purchase renewable energy, and those suppliers have primarily opted to tap the plentiful wind resources in the western part of the State. As a result of the RPS, in combination with its energy needs and robust renewable resource base, Texas is now the second largest generator of wind energy in the country with 1,293 megawatts of installed wind capacity at the end of 2004. New legislation is being introduced in Texas this year that would expand the current RPS to increase installed capacity of renewable resources to 5,000 MW by 2015, and 10,000 MW by 2025, representing 10 percent of the State's predicted energy needs.

The RPS policies in Texas, New York, Minnesota, California, Colorado, Pennsylvania, and New Mexico are expected to deliver significant new wind capacity additions in the years to come. Coupled with the Production Tax Credit for wind, the high quality wind resources and renewables portfolio standards found in these states are serving to stimulate development of new wind energy projects.

New Jersey stands out as an example of a state that has adopted an innovative set of policies and programs to advance solar power. Along with an RPS, New Jersey has a green tag purchase program, a solar renewable energy certificates program, a tax exemption for solar and wind systems, and a clean energy rebate program, just to name a few. New Jersey's RPS specifically calls for a solar set-aside that will drive approximately 90 megawatts of solar electric generation by 2008 as part of the State's 4 percent Class I renewables requirement. New Jersey's Solar Renewable Energy Certificates (S-RECs) program provides a means for solar certificates to be created and verified and allows the certificates to be sold to electric suppliers to meet their solar RPS requirement. All electric suppliers are required to use the S-RECs program to show compliance with this part of the State's renewable portfolio standard. New Jersey's on-line marketplace for trading S-RECs, launched on June 25, 2004, is among the first in the world. Solar projects funded by the State's Clean Energy Program also qualify for RPS compliance, and New Jersey has developed over 5 megawatts of solar through the Clean Energy Program and will continue to provide incentives to help meet the 90 megawatts goal. Other states that have developed solar-focused set-asides as part of their overall RPS include Arizona, Nevada, Colorado, Pennsylvania and New York, as well as Washington D.C.

Four RPS-States have significant geothermal resource potential: California, Nevada, New Mexico, and Arizona. After a decade of dormancy, the market for geothermal power projects is now "picking up steam," partly due to the state renew-

²(Source: An Investor's Guide to Renewable Power Technologies, Markets, and Policies, Nov. 2004)

ables portfolio standards. For instance, in California, 235 megawatts of new geothermal capacity is currently under development. In Nevada, Nevada Power has agreed to purchase 50 MW of power from three new geothermal facilities expected to be on-line in 2005. Furthermore, Platt's reports that there are 600 MW of new geothermal contracts with utilities in California and the Northwest that have not yet been publicly disclosed.³

However, state experiences in setting and implementing RPS programs also suggest that we need to be cautious in how we use regulations to stimulate renewable energy markets. If the RPS target is too aggressive, supply constraints and high costs may result. These and other challenges have been confronting many states in the design and implementation of their RPS policies, and not all of these RPS policies are operating smoothly. We believe that governors, state legislatures, energy companies, and other regional stakeholders are in the best position to develop a portfolio standard that will meet their states' energy, environmental, and economic needs.

Outside of the renewables area, the Department is also supporting efficiency and cost improvements in other technologies that offer potential for diversifying our Nation's power generation portfolio and reducing pollution and greenhouse gases. In nuclear energy, for example, despite the remarkably improved operating record of the 103 current U.S. reactor plants over the last decade-and-a-half, no new plants have been ordered since the 1970s. Only an incremental expansion in capacity is underway in the U.S. from uprates of current plants (over 3,500 megawatts have been approved, with another 2,000 MW expected) and from the Tennessee Valley Authority's work to bring Browns Ferry Unit 1 back on line by 2007. With only this minor increase in capacity, nuclear generation, which represents nearly three-quarters of our Nation's non-emitting generation today, will not keep pace with growing electricity demand, and its share of the electricity mix, which now is as high as 50 to 75 percent in some states, will fall. Unless new plants are ordered, the nuclear option will be limited to providing today's level of environmental and energy security benefits, foregoing the large potential for additional improvements that would come from new plants. The Administration's FY 2006 Budget addresses this issue by proposing approximately \$500 million over six years for the Nuclear Power 2010 program to assist two consortia through the nuclear design and certification process.

Another important resource pathway for cleaner, more efficient electricity generation is Integrated Gasification Combined Cycle (IGCC) technology that converts coal and other hydrocarbons into synthetic gas, which after cleanup is used as the primary fuel for a gas turbine in a combined-cycle system. IGCC systems offer significant environmental benefits compared to traditional pulverized coal power plants, the mainstay of the Nation's electricity generation portfolio. Two IGCC plants, which were built under the Department of Energy's (DOE) Clean Coal Technology Program, are producing commercial electricity in Florida and Indiana, and new locations are being proposed. Although still comparatively expensive, IGCC's future is promising because of its flexible feedstocks, process options and products; its ability to open new markets for coal; and its potential for low-cost emissions reduction, including the option of capturing CO₂ emissions for subsequent geologic storage. The Department is supporting research, development, and demonstration on a number of advancements that will significantly drive down the costs of IGCC.

I want to close my statement by noting that while there are a number of policies and programs in place today to bring renewables into the mainstream, the most encouraging sign to me is that many renewable projects are being pursued because they are money-making options for investors. This is largely due to the technological advances that have occurred through the years of sustained Federal and private sector investment in renewables research and development.

This completes my prepared statement, and I am happy to answer any questions the Committee may have.

The CHAIRMAN. Thank you very much.

Mr. Brunetti, before you testify, I want to indicate that I am advised that Xcel, whom you represent, or are part of, announced, just yesterday, that they plan to build a 120-megawatt wind farm in New Mexico. Is that correct?

Mr. BRUNETTI. That's correct. We just announced it yesterday, sir.

³An Investor's Guide to Renewable Power Technologies, Markets, and Policies, Nov. 2004, p.33

The CHAIRMAN. And where will that be?
 Mr. BRUNETTI. It's in the press release I gave Senator Bingaman.
 The CHAIRMAN. Right. Okay.
 Would you proceed with your statement.

**STATEMENT OF WAYNE BRUNETTI, CHAIRMAN AND CEO,
 XCEL ENERGY, INC., MINNEAPOLIS, MN**

Mr. BRUNETTI. Thank you, Mr. Chairman, Senator Bingaman, and members of the committee. I want to thank you for the opportunity for Xcel to be here today to talk about our thoughts on diversification on power generation.

As you may know, we are, by customer measure, the fourth largest utility, serving ten Midwestern and Western States in the United States. We are particularly pleased to provide electricity from renewables located in, or planned for, States of several Committee Members, including yours, as you just mentioned, Mr. Chairman, and Senator Bingaman, as well as in Colorado, where Senator Salazar, and North Dakota, Senator Dorgan; plan some in South Dakota; and we do have resources in Wyoming.

Over the years, I think we've learned a lot about the utilization of renewable resources, and I hope, today, to provide you some insight on how to balance these resources.

At the outset, Xcel believes that an overriding objective for Federal policy should be to develop and implement a wide diversity of power generation resources, while preserving and enhancing reliability. We need to encourage the use of all low- or non-emitting electric generation technologies throughout our economy. Renewable resources are a key component of such a policy, but only a component. We should not ignore increased efficiency and inherently clean technologies that increase fuel diversity.

At Xcel, we're committed to generation diversity as a sound economic principle. It protects us against price spikes in a single fuel source. Fuel diversity also enhances national security by reducing our reliance on the single generation source.

In Minnesota, we will soon employ nine separate generation resources. In 2004, we announced our intention to increase our wind capacity from 487 megawatts to 1,120 megawatts by 2010. By the end of 2005, we expect our customers—with an additional 160 megawatts in Texas, for a total of 243 megawatts, increase wind from two megawatts to 202 in New Mexico, deploy an additional 12 megawatts of wind in North Dakota, and increase wind generation in Colorado, by the end of 2005, to 353 megawatts.

By 2053, Xcel will be the—have the highest penetration of non-hydro renewable resources of any utility in the United States. We also have a very successful green pricing program, called Windsource, which has been replicated in some other States. We also have 1,400 megawatts of controllable load, which is an important part of the portfolio.

Well, we're proud of the record, but it's also important to remember, the reason we pursued this course is because we could. As many of you know, wind is a traditional renewable resource that approaches economic viability, compared to fossil and nuclear generation. Even that would not be true without the production tax credit.

Xcel Energy's service includes America's—some of America's best classified wind resources, as can be seen by this chart. We're fortunate in that regard. As the chart behind me shows, other utilities are not so lucky. Regional difference in renewable resources availability means that wind-heavy programs, like those in my States, are impractical in others. It's important to note that States have stepped forward and acknowledged this.

Currently, there are actually 21 States that have some sort of renewable portfolio standard. Five of the States in which we operate—Minnesota, Colorado, Texas, New Mexico, and Wisconsin—have instituted some type of standard. While it makes sense to work toward a more uniform approach over time, current State program were developed to best suit the needs and resources available in those States. It is not necessary today to harmonize these programs with a national standard.

While it's not my intention to propose any particular Federal program, I would like to outline some concepts that are important for you to consider.

As we have previously indicated, we strongly believe that any Federal program should defer to existing State programs. Many companies have, already, a number of programs, and have made long-term commitments, resource commitments.

Second, any Federal program must allow for cost recovery in the implementation of those. For example, transmission costs to move wind power from high quality resource areas where the wind blows to low centers often outstrips the cost of the projects, themselves.

Another cost of wind centers: plant performance. Fossil plants must be cycled up and down, depending on the intensity of the wind. This causes extreme stress on those facilities supporting large wind developments, and shortens the useful life of very solid facilities.

Third, Federal generation diversity needs to include more than traditional resources—things like fuel cells, photovoltaic, nuclear IGCC. And if a Federal program is undertaken for those States without programs, it should at least be put in the form of a mandate for service providers to offer renewable and conservation services to the market. Such must-offer programs have been highly successful in many parts of the country.

In concluding, an approach of this sort, I think, is far superior to straight "one size fits all" mandates. The proposal enlists utilities as partners, in energy conservation renewable development. Since it would be in the utilities' interest to ensure that statutory goals are met, this concept would unleash creative marketing/financing approaches to energy conservation and renewable development.

And, with that, I'll conclude my remarks. Thank you, Mr. Chairman.

[The prepared statement of Mr. Brunetti follows:]

PREPARED STATEMENT OF WAYNE BRUNETTI, CHAIRMAN AND CEO,
XCEL ENERGY, INC., MINNEAPOLIS, MN

Chairman Domenici, Senator Bingaman and Members of the Committee, I thank you for the opportunity to provide Xcel Energy's views on ways to encourage the diversification of power generation resources and the role of renewable energy in our national energy strategy.

Xcel Energy serves 3.3 million electricity customers and 1.8 million natural gas customers in 10 midwestern and western states. Measured by number of customers, we are the fourth-largest combination natural gas and electricity company in the nation.

We are particularly pleased to provide electricity from renewable projects located in the states of several committee members, including yours, Mr. Chairman and Senator Bingaman, as well as Colorado, Senator Salazar; North Dakota, Senator Dorgan; and Wyoming, Senator Thomas.

Over the years, we have learned a lot about the utilization of renewable resources. What I hope to do today is to provide you with a balanced perspective on the various factors—economic, technical and regulatory—that affect the deployment and utilization of renewable energy as part of our nation's generation mix.

At the outset, Xcel Energy believes that an overriding objective for federal policy should be to develop and implement a wide diversity of power generation resources while preserving and enhancing reliability. We need to encourage the use of all low and non-emitting electric generation technologies throughout our economy. Renewable resources are a key component of such a policy—but not the only component. We should not ignore increased efficiency (conservation) or inherently “clean” technologies that increase fuel diversity.

XCEL ENERGY IS COMMITTED TO RESOURCE DIVERSITY

At Xcel Energy, we are committed to generation diversity as a sound economic principle.

It protects us against price spikes in any single fuel source. Fuel diversity also enhances national security by reducing our reliance on any single generation source.

In Minnesota, we will soon employ nine separate generation resources. In 2004, we announced our intention to increase installed wind capacity in Minnesota from 487 MW to approximately 1125 MW by 2010.

By the end of 2005, we expect to provide our customers with an additional 160 MW of wind power generated in Texas, for a total of 243MW; increase wind power from 2MW to 202 MW in New Mexico; deploy an additional 12 MW of wind power in North Dakota; and increase wind power generated in Colorado by the end of 2005 from 222MW to 353MW.

By 2015, Xcel Energy will have among the highest penetration of non-hydro renewables on our system of any utility in the nation. We also offer our customers one of the nation's most successful green pricing programs, known as Windsource, and some of the country's most effective conservation and DSM programs. We have more than 1,400 MW's of controllable load on our system.

STATE PROGRAMS

While we are proud of our record in renewables, it is also important to remember that one reason we pursued this course is because we could.

As many of you know, wind is the “traditional” renewable resource that approaches economic viability compared to fossil or nuclear generation for most suppliers. Even that would not be true without the Production Tax Credit. (As an aside, the PTC must be renewed for a significant period if we are to avoid planning disruptions and the attendant cost increases that result. But that is a different story.)

Xcel Energy's service territory includes much of America's class 5 wind resources. We are fortunate in that regard. As the charts behind me show, other utilities are not so lucky. Regional differences in renewable resources availability means that wind-heavy programs like those in my states are impractical in others.

It is important to note that states have stepped forward in acknowledgement of this fact.

Currently twenty-one states have some sort of renewable portfolio standard in place.¹ Because of the wide variability in available renewable resources and the existing generation and transmission systems in each of these states, the nature of these programs varies considerably.

FEDERAL PROGRAMS?

Five states in which we operate—Minnesota, Colorado, Texas, New Mexico and Wisconsin—have instituted some type of renewable standard. While it makes sense to work toward a more uniform standard over time, current state programs were developed to suit the needs and resource availability of each jurisdiction. It is not

¹ For a complete listing, visit the *Database of State Incentives for Renewable Energy* (DSIRE) at <http://www.dsireusa.org>.

necessary today to harmonize these programs which are already benefiting the public and the environment but it is an objective that bears consideration in the future.

While it is not my intention to propose any particular federal program, I would like outline some concepts important for your consideration. First, as we have previously indicated, we strongly believe that any federal program should defer to existing state programs. Many companies already participate in a number of programs and have made long-term resource plans based on their assumptions.

Second, any federal program must allow for cost recovery of the various costs necessary to implement the program. For example, transmission costs to move wind-power from high quality resource areas to load centers often outstrip the costs of projects themselves. (I'll talk a little more about transmission later.) Another cost of wind centers on plant performance. Fossil plants must be cycled up and down depending on wind intensity. This creates stress on those facilities supporting large wind developments and shortens their useful service life.

Third, any federal generation diversity program needs to include more than the "traditional" renewable energy resources. We believe that the program should take into account all low-or non-emitting technologies plus activities by utilities that reduce demand. Consistent with this suggestion above, products including customer-located solar, photovoltaic, fuel cell and micro wind generators, as well as energy efficient heating and cooling equipment and weatherization products should be included. Resource definitions could also be expanded to include IGCC and other inherently "clean" new generation resources.

Again, if a federal program is undertaken for those states without programs (and I am not particularly advocating this), it should, at least initially, be put in the form of a mandatory offer to customers.

Such "must offer" programs have been highly successful in many parts of the country, including ours. Under this type of program, retail suppliers would be required to offer low-emitting generation or energy conservation products to its customers.

Finally, and only as a backstop to the entire program, a mandatory Resource Portfolio Standard could become effective further in the future if reasonable goals were not achieved. Existing state programs would be grandfathered. And, of course, to be fair any federal program should apply to *all* retail suppliers.

While this is only an outline, I stand ready to provide the committee with further details.

CONCLUSION

An approach of this sort is, I believe, far superior to a straight "one size fits all" mandate.

The proposal enlists utilities as partners, in energy conservation and renewable energy development. Since it would be in utilities' interests to ensure that the statutory goals are met, this concept would unleash creative marketing and financing approaches to energy conservation and renewable development. It may also present new business opportunities for retail suppliers.

Moreover, the changes described above would enhance the role of energy conservation and small-scale renewable development in our national energy system. By placing these resource opportunities on the same playing field with larger scale renewable projects, we enhance the opportunities for supply diversity, technological advancement and entrepreneurship. This is particularly important for the photovoltaic, fuel cell and energy conservation product industries.

Finally, this approach would leave in place carefully designed state-level programs that have already done a great deal to advance renewable energy in this country.

In closing, I would ask that the committee think about grid expansion as a vital part of developing new and cleaner generation resources. H.R. 6, the energy bill you considered last year, included several provisions designed to promote the grid expansions necessary to get wind and other new sources to load centers. Four of those are worth specific mention: federal "backstop" siting authority, provisions to expedite siting on Federal lands, instruction to FERC for incentive rate treatment and accelerated depreciation schedules for transmission assets. Each of these is vital both to ensure the reliability of our current system and to encourage development of new renewable and other generation sources.

At this point I will stop and be ready to answer any questions. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much.

Could I clarify, Mr. Secretary? You said, in your description of the total—of the components of the total, 9 percent renewables. And I don't think you broke that down into hydro and others. Could you do that?

Mr. GARMAN. Yes.

The CHAIRMAN. I think it's—

Mr. GARMAN. Roughly 7 percent hydroelectric, 2 percent non-hydro renewables.

The CHAIRMAN. So if we're talking about wind as a—in that category, it would be part of the two, nationally, now, which included other than wind.

Mr. GARMAN. It would be a small portion. The bulk of that 2 percent comes from wood waste, biomass, pulp mills burning fuel, generating fuel.

The CHAIRMAN. All right. Thank you very much.

Dr. Wiser, would you proceed, please?

**STATEMENT OF DR. RYAN WISER, SCIENTIST, LAWRENCE
BERKELEY NATIONAL LABORATORY, BERKELEY, CA**

Dr. WISER. Thank you, Mr. Chairman, members of the committee. It really is a privilege for me to be here today.

My name is Ryan Wiser. I'm a scientist at Lawrence Berkeley National Laboratory, where I conduct renewable energy research.

I'm here this afternoon to report on the findings of a recent study that I conducted, a study that explores the relationship between natural gas prices, on one hand, and investments in renewable generation and energy efficiency, on the other.

In short, as I will describe briefly this afternoon, this study shows that diversification away from natural gas fire generation could put significant downward pressure on natural gas prices, and, thereby, provide important benefits to consumers.

Now, just to be clear, I am here as an analyst to report the result of this research, and not to take a specific policy position on the issues of diversity, incentives, and standards.

And to summarize the results of our study, I'd like to highlight four succinct points:

First, we have very clearly seen a structural shift in the natural gas sector, a shift that has already led to more than a doubling of natural gas prices. Given this, most would agree that both—that a balanced energy policy must both expand the supply of, and reduce the demand for, natural gas. And I certainly comment this committee for its leadership in exploring both sets of these options.

Second, our study specifically highlights the fact that increased renewable energy and energy efficiency can be an important part of the solution by reducing gas demand and, thereby, reducing gas prices. In fact, a growing number of modeling studies are showing this very effect, and our report summarizes those studies and, perhaps for the first time, evaluates and reviews the reasonableness of their findings in light of economic theory and other analyses.

In particular, our report reviews 13 different studies, most of which explore a national renewables portfolio standard, though some evaluate state RPS policies, and others also include energy efficiency.

Those studies that evaluate the impact of aggressive levels of renewable energy deployment find that such efforts could reduce demand for natural gas by as much as three to four quads a year by 2020, or about 10 percent of projected gas consumption. In that instance, well-head gas price reductions can be as high as 50 cents per million Btu or more than 10 percent of projected gas prices, resulting in aggregate consumer gas savings in 2020 that exceed \$15 billion in that year alone.

Less aggressive levels of renewable energy development, not surprisingly, are found to reduce gas prices more modestly, perhaps by 3 percent or so, or about 15 cents per million Btu.

Now, these potential consumer benefits clearly are reasonably significant. In fact, the studies often show that any predicted increase in the price of electricity caused by greater use of renewable energy and energy efficiency is largely or completely offset by the projected natural gas price savings. And, at least at the high end of the possible savings, these natural gas price reductions are similar in magnitude to those that have been predicted to come from aggressive supply side actions, such as increasing access to Alaskan gas and/or overseas liquified natural gas.

Third, I think it is very important to acknowledge that these consumer benefits, at least to some degree, come at the expense of natural gas producers. Nonetheless, if policymakers are concerned about the impact of natural gas prices on consumers, or are concerned about the macroeconomic impacts of higher gas prices on the U.S. economy, then policies to reduce gas demand might well be considered appropriate.

In addition, given anticipated future growth in imported natural gas, the gain to U.S. consumers would come, at least in part, at the expense of foreign producers; thereby, ensuring aggregate welfare gains for the United States as a whole.

Fourth, while more work clearly needs to be done on this particular topic, we find that these modeling results appear reasonable, and appear likely to really be true, and, in fact, should be considered in policymaking. In particular, the results are consistent with, or even conservative, relative to six major energy models reviewed recently by Stanford's Energy Modeling Forum, and are also consistent with an energy model recently used by the National Petroleum Council and the National Commission on Energy Policy.

So, to conclude, most would agree that both supply side and demand side actions will be necessary to moderate natural gas prices. Our study highlights the important role that renewables and efficiency might play in that process.

Of course, I want to acknowledge that these effects are not strictly limited to renewable energy and energy efficiency. In fact, similar gas price reductions would result from increased use of any energy source that displaces natural gas consumption, which would include coal and nuclear power, as well.

In addition, a comprehensive analysis of the costs and benefits of policy efforts must consider other impacts, as well. Of course, it's clearly not appropriate to look only at the natural gas price impacts when evaluating policies. Nevertheless, given present concerns about natural gas prices and the findings of our study, I believe that evaluations of policies to encourage fuel diversification

would be well served to analyze the potentially beneficial impacts of that diversification on natural gas prices.

With that, I'll conclude my statement. I'd be happy to answer any questions at the appropriate time.

[The prepared statement of Dr. Wiser follows:]

PREPARED STATEMENT OF DR. RYAN WISER, SCIENTIST, LAWRENCE BERKELEY NATIONAL LABORATORY

EASING THE NATURAL GAS CRISIS: REDUCING NATURAL GAS PRICES THROUGH ELECTRICITY SUPPLY DIVERSIFICATION

Mr. Chairman and Members of the Committee, I appreciate the opportunity to appear before you today. My name is Ryan Wiser, and I am a Scientist at Lawrence Berkeley National Laboratory (Berkeley Lab). Since 1995, I have conducted renewable energy research at Berkeley Lab; research that has been funded in large part by the U.S. Department of Energy.

I am here today to report on the findings of a recent study that I helped manage and conduct, a study titled *"Easing the Natural Gas Crisis: Reducing Natural Gas Prices Through Increased Deployment of Renewable Energy and Energy Efficiency."* This study explores the relationship between renewable generation and energy efficiency investments and natural gas prices. As I will describe, the report finds that by reducing natural gas demand, deployment of renewable energy and energy efficiency could put significant downward pressure on natural gas prices and thereby provide sizable consumer savings.

To be clear, I am here to report the results of this study, and not to take a specific policy position on the issues of diversity incentives or standards. Let me also note that my remarks are my own, and not those of Berkeley Lab or the U.S. Department of Energy.

THE CURRENT SITUATION WITH NATURAL GAS

I think we can all agree that we have seen a structural shift in the natural gas sector; a shift that has already led to more than a doubling of natural gas prices and an increase in price volatility.

From around \$2 per mmBtu in the 1990s, average wellhead natural gas prices rose to \$4.10 per mmBtu from 2000 through 2004, and \$5.40 per mmBtu in 2004 alone. The 6-year NYMEX forward curve shows that the gas market expects prices at the Henry Hub to remain in the \$5 to \$8 per mmBtu range for at least the next six years, while the Energy Information Administration's (EIA) latest forecast projects that wellhead prices will average more than \$5/mmBtu in the coming 20 years (all prices are reported in nominal dollars). Though both market and government forecasts of long-term gas prices have been notoriously inaccurate, we appear to be at a point where demand for natural gas is beginning to exceed our current ability to economically extract the fuel from domestic reserves.

At the same time, natural gas is a fuel with many positive attributes, and as a result its use in the residential, commercial, industrial, and power sectors is expected by the EIA and others to continue to increase. The power sector, especially, has been driving, and is projected to continue to drive, growth in natural gas demand. For example, from 1998 to the present, over 80% of the new generating capacity in the U.S. has been fueled with natural gas.

Correcting the present imbalance between natural gas supply and demand will clearly be a challenging task, and most would agree that a balanced energy policy must both expand the supply of, and reduce the demand for, natural gas. I commend this Committee for its leadership in exploring both sets of options, though for the remainder of these remarks I will be focusing on the potential benefits of demand-side measures.

SUMMARY OF THE BERKELEY LAB STUDY

With the recent run-up in natural gas prices, and the expected continuation of volatile and high prices for at least the mid-term future, a growing number of voices are calling for increased diversification of electricity supplies. Such diversification holds the prospect of directly reducing our dependence on a fuel whose costs are highly uncertain, thereby hedging the risk of natural gas price volatility and escalation. In addition, as I will describe in a moment, by reducing natural gas demand, increased diversification away from gas-fired generation can *indirectly* suppress natural gas prices.

Our report highlights the impact of increased deployment of renewable energy and energy efficiency on natural gas prices and consumer natural gas bills. A growing number of modeling studies conducted by government, non-profit, and private sector entities are showing that renewable energy and energy efficiency could significantly reduce natural gas prices and bills. *Our report summarizes these recent modeling studies and reviews the reasonableness of their findings in light of economic theory and other analyses.* (Though our report focuses on renewable energy and energy efficiency, other non-natural-gas resources would likely have a similar effect).

We find that, by displacing natural-gas-fired electricity generation, increased levels of renewable energy and energy efficiency will reduce demand for natural gas and thus put downward pressure on gas prices. These price reductions hold the prospect of providing consumers with significant natural gas bill savings. In fact, although we did not analyze in detail the electricity price impacts reported in the studies, the studies often show that any predicted increase in the price of electricity caused by greater use of renewable energy or energy efficiency is largely or completely offset by the predicted natural gas price savings. We conclude that policies to encourage fuel diversification within the electricity sector should consider the potentially beneficial cross-sector impact of that diversification on natural gas prices and bills.

ECONOMIC THEORY

Our report confirms that the natural-gas-price reductions projected by earlier modeling studies are consistent with economic theory. Increased renewable energy and energy efficiency will cause an inward shift in the natural gas demand curve, leading to lower natural gas prices than would have been realized under the higher-demand conditions. Similar natural gas price reductions would likely result from increased use of other non-natural-gas energy sources that displace natural gas consumption (e.g., coal, nuclear).

The magnitude of the price reduction will depend on the amount by which natural gas consumption is reduced, as well as the shape of the natural gas supply curve (measured by the inverse price elasticity of natural gas supply, or the percentage change in price caused by a one percent change in demand). Given the ability of natural gas supply and demand to adjust to altered prices over time, the price reduction is likely to be greater in the near term than over the longer term.

These reductions in gas prices benefit consumers by reducing fuel costs faced by electricity generators, and by reducing the price of natural gas delivered for direct use in the residential, commercial, industrial, and transportation sectors. According to economic theory, this benefit to consumers will, to some degree, come at the expense of natural gas producers. However, if policymakers are concerned about the impact of natural gas prices on consumers, or are concerned about the macroeconomic impacts of higher gas prices on overall economic activity, then policies to reduce gas demand might be considered appropriate. In addition, given anticipated future growth in imported natural gas, reducing natural gas prices may well enhance social welfare in the United States (because the gain to U.S. consumers comes, in part, at the expense of foreign producers).

REVIEW OF PREVIOUS STUDIES

The Berkeley Lab report reviews five different studies by the Energy Information Administration (EIA), six by the Union of Concerned Scientists (UCS), one by the Tellus Institute, and one by the American Council for an Energy-Efficient Economy (ACEEE) (see the References section for a full listing of these studies). In aggregate, these thirteen studies report results of twenty different modeling runs, which we review in our report. Most of the studies evaluate national renewables portfolio standard (RPS) proposals, though some evaluate state RPS policies and others also include energy efficiency investments. The vast majority of these studies rely on the National Energy Modeling System (NEMS), an energy model developed and operated by the EIA to provide long-term energy forecasts. Though these studies seek to evaluate a full range of economic impacts, the focus of the Berkeley Lab work is on the natural gas demand and price impacts.

As shown in our full report, these studies consistently find that renewable energy and energy efficiency deployment will reduce natural gas demand, thereby putting downward pressure on gas prices.

The level of demand and price reduction depends in large part on the level of renewable energy and energy efficiency deployment. Those studies that review the impact of more aggressive national renewable energy deployment efforts have found that such efforts could reduce demand for natural gas by as much as 3 to 4 quadril-

lion Btu (Quads) a year by 2020, or 10% of projected national gas consumption, with a mean reduction across studies of approximately 2 Quads (7%). Less aggressive levels of national deployment are found to reduce gas consumption studies of 0.7 Quads (2%).

At the higher end of the demand-reduction spectrum, the drop in demand is expected to lead to wellhead price reductions that can be as high as \$0.5 per mmBtu (17% below projected wellhead prices in 2020), with a mean reduction across studies of \$0.3 per mmBtu (10%). At the high end of this range, aggregate consumer gas savings in 2020 exceed \$15 billion. Less aggressive levels of demand reduction are found to reduce gas prices by as much as \$0.3 per mmBtu (13%), with a mean reduction across studies of around \$0.15 per mmBtu (5%). (See Table 1, and Figures 1 and 2 in the Appendix).* Note that, on the high end at least, these price reductions are similar in magnitude to those estimated to come from increased access to Alaskan gas and/or liquefied natural gas imports, as reported in recent studies by Stanford's Energy Modeling Forum and the National Commission on Energy Policy.

Another key source of variation among the studies' results lies in their assumptions about the shape of the natural gas supply curve. A quantitative measure of that shape is the long-term average inverse price elasticity of natural gas supply. Of the twenty modeling runs that we reviewed, thirteen show an average inverse price elasticity of natural gas supply in the range of 0.8 to 2. This means that each 1% reduction in national gas demand is expected to lead to a long-term average reduction in wellhead gas prices of 0.8% to 2%. Some studies predict even larger impacts, especially in the near term. In fact, of the remaining seven modeling runs, five show even more significant price reductions—up to a 4% price reduction for each 1% drop in demand. (See Figure 3, in the Appendix).

Overall, among those analyses that evaluate aggressive levels of national renewable energy development, nine of fifteen find that such deployment might provide natural gas bill savings in the range of \$10 to \$40 billion from 2003-2020 (on a national, net present value basis). These savings are often more than enough to offset any predicted increase in the price of electricity that is caused by greater use of renewable energy sources. (See Figure 4, in the Appendix).

Results from these studies further suggest that each megawatt-hour (MWh) of electricity generated from a renewable resource provides, on average, national consumer benefits (in the form of natural gas bill savings) that are typically in the range of \$10 to \$20/MWh. Even at the lower end of this range, these savings are significant relative to the current cost of supplying electricity from renewable resources, which averages perhaps \$30 to \$70 per MWh.

BENCHMARKING OUR RESULTS WITH OTHER RESEARCH

These consumer gas bill savings are clearly significant. But what level of confidence should be placed on these modeling results? After all, most of these results derive from a single energy model: NEMS. To answer this question, we sought to compare the results of the various modeling studies to each other, to the results of other national energy models, and to the empirical economics literature. We did this to test for model consistency over time, across models, and with economic theory.

The details of these comparisons can be found in the full report, but to summarize, we conclude that there remains significant uncertainty about the exact magnitude of the natural gas price reduction. However, we also find that each comparison provides reason to believe that the price-suppression effect is real, and that the studies reviewed above have characterized this effect within reason, given the state of current knowledge.

For example, four of six energy models (POEMS, CRA, E2020, MARKAL) used in a recent study by Stanford's Energy Modeling Forum show results consistent with those of the thirteen studies reported earlier, while the two outliers (NANGAS, NARG) display price-reduction impacts that are *greater* than those of the thirteen studies reported previously (See Table 2, in the Appendix). Meanwhile, the energy model from Energy and Environmental Analysis, Inc. (EEA), which was used by the National Petroleum Council and the National Commission on Energy Policy in their recent work, suggests that the long-term impact of demand reductions on natural gas prices will be at least double that reported earlier (i.e., a 1% decline in demand will result in a 4%+ drop in natural gas prices, compared to the 0.8-2% drop reported earlier).

While more work needs to be done on this topic, in the meantime, existing modeling results appear to be reasonable and should not be dismissed.

*The appendix has been retained in committee files.

CONCLUSION

Elevated natural gas prices have emerged as a key energy-policy challenge for at least the early part of the 21st century. While our nation will continue to rely on natural gas, most agree that both supply-side and demand-side actions will likely be necessary to moderate prices. Focusing on just the demand side, our study has found that increased diversification of energy supplies should help to alleviate the threat of high natural gas prices over the short and long term, thereby reducing consumer natural gas bills.

The thirteen studies and twenty specific modeling analyses reviewed in our report consistently show that increased use of renewable energy and energy efficiency can begin to reduce natural gas prices. Our report is the first to demonstrate that these results are broadly consistent with economic theory, results from other national energy models, and limited empirical evidence.

Of course, these effects are not strictly limited to renewable energy and energy efficiency investments: any non-natural-gas resource that displaces gas use is expected to provide similar consumer benefits. In addition, a comprehensive analysis of the costs and benefits of policy efforts must consider other impacts as well, including impacts on electricity rates, national security, environmental outcomes, and economic development. Nonetheless, given present concerns about natural gas prices and the findings reported in this testimony, I believe it is prudent to carefully evaluate the cross-sector impacts of electricity-sector diversification policies on the natural gas market.

Senator BINGAMAN [presiding]. Thank you very much.

Mr. Morgan, why don't you go right ahead?

**STATEMENT OF RICHARD E. MORGAN, COMMISSIONER,
DISTRICT OF COLUMBIA PUBLIC SERVICE COMMISSION, ON
BEHALF OF THE NATIONAL ASSOCIATION OF REGULATORY
UTILITY COMMISSIONERS**

Mr. MORGAN. Good afternoon, Mr. Chairman and members of the committee.

I'm Richard E. Morgan, commissioner on the Public Service Commission of the District of Columbia. I'm here today representing the National Association of Regulatory Utility Commissioners, or NARUC. On behalf of NARUC, I'd like to thank you for this opportunity to share our views with you.

NARUC is a quasi-governmental, nonprofit organization founded in 1889. Its membership includes the State public utility commissions for all states and territories. NARUC's mission is to serve the public interest by improving the quality and effectiveness of public utility regulation. NARUC's members regulate the retail rates and services of electric, gas, water, and telephone utilities.

NARUC has often emphasized the importance of promoting a diversified power generation portfolio, including renewable energy resources, in light of the significant benefits that clean energy resources can bring. These benefits include reducing energy price volatility, increasing energy independence, increasing diversity in energy supply, improving reliability, increasing energy security, and reducing the impact of energy resources on the environment.

In particular, many States are concerned by recent natural gas price volatility, and are looking at options, such as renewable energy, to alleviate this problem. Analyses by government, industry, and environmental interest groups have shown that renewable energy can provide a hedge against volatile and escalating gas prices by reducing exposure to gas price risk and slowing the increase in these prices.

NARUC believes that States have a central role to play in encouraging a diverse supply of power generation and developing

clean power resources. To date, approximately 18 States and the District of Columbia have established some level of renewable portfolio requirements. In addition, 23 States have some form of tax incentives for renewables, 17 States have loan or grant programs to provide support for capital projects, and seven States offer payment programs for renewables funded by system benefit charges.

To give some idea of why States are adopting policies to promote renewables, I'd like to read a quote from New York Public Service Commission Chairman William Flynn. Chairman Flynn says, regarding RPS, "Not only will it help us meet our growing demand for electricity, but it will also provide additional benefits by increasing fuel diversity from our State's generation portfolio, reducing our exposure to fossil fuel price spikes and supply interruptions, increasing economic development activity from a growing renewable energy industry, and improving our environment."

And I'd like to also—I'm sorry—NARUC has not taken a formal position on the necessity for a Federal renewable portfolio standard. However, we believe that the—consistent with any adopted national standards for renewable energy supply, States should be afforded maximum flexibility to structure, apply, and supplement standards within the State in a way that best promotes the unique resource, technology, and economic goals of each State.

I have, for your information and review, attached an appendix containing a short sample of State RPS programs.

Additionally, I would like to bring your attention to a February 2001 report prepared on behalf of NARUC, entitled "The Renewables Portfolio Standard: A Practical Guide." This report has been widely used as a resource to governmental, industry, and environmental organizations across the country. It is aimed at assisting State policymakers and policy analysts in defining the particular goals they seek to achieve with an RPS. With many of these decisions there is no single right approach; rather, the option chosen will depend on the circumstances in each State and the intended goals of policymakers. Unfortunately, the report's too lengthy to include with this testimony, but it can be accessed on the NARUC Website.

I would like to take a moment to read a brief couple of excerpts which help explain what an RPS is and why it's become a favored policy.

This is a quote from the NARUC report, "The essence of an RPS, properly structured, is captured by three characteristics. First, the RPS advances renewable energy resources in the most efficient way possible by maximizing reliance on the market. This efficiency is enhanced if the obligation is tradable. Second, the RPS maintains and increases the quantity of renewables in the system over a long period of time. Third, noncompliance penalties ensure that retail sellers will act to meet the State's renewable energy goal. These characteristics distinguish the RPS from other types of renewable energy policies, such as government subsidy programs and tax credits."

And, further, "Efficiency is maximized because, one, the RPS policy allows each retail seller to meet its renewable energy obligation as efficiently as possible. Efficiency is assured, because the RPS does not prescribe the particular technologies, resources, or projects

that the retailer must use to meet its obligation or provide particular levels of support to particular projects."

NARUC believes Congress should encourage clean energy resources as a tool to achieve fuel diversity and greater energy security. Additionally, to assist States in the promotion of expansion of diverse power generation resources, Congress could support policies that would complement State efforts to ensure that regional transmission organizations and other regional bodies have sufficient authority to conduct long-term planning for their regions and, working with the States and transmission owners, implement long-term planning. And we list a number of items here, but I won't take the time; they are included in the testimony.

So, with that, I'll conclude my remarks and say that I would like—I appreciate the opportunity to appear before you. We look forward to working with you on this issue in the future.

Thank you very much.

[The prepared statement of Mr. Morgan follows:]

PREPARED STATEMENT OF RICHARD E. MORGAN, COMMISSIONER, DISTRICT OF COLUMBIA PUBLIC SERVICE COMMISSION, ON BEHALF OF THE NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS

Mr. Chairman and members of the Committee, I am Richard E. Morgan, Commissioner on the Public Service Commission of the District of Columbia and I am here today representing the National Association of Regulatory Utility Commissioners (NARUC). On behalf of NARUC, thank you for this opportunity to share our views with you.

NARUC is a quasi-governmental, nonprofit organization founded in 1889. Its membership includes the State public utility commissions for all States and territories. NARUC's mission is to serve the public interest by improving the quality and effectiveness of public utility regulation. NARUC's members regulate the retail rates and services of electric, gas, water and telephone utilities. We have the obligation under State law to ensure the establishment and maintenance of such energy utility services as may be required by the public convenience and necessity, and to ensure that these services are provided at rates and conditions that are just, reasonable and nondiscriminatory for all consumers.

NARUC has often emphasized the importance of promoting a diversified power generation portfolio including renewable energy resources in light of the significant benefits that clean energy resources can bring. These benefits include reducing energy price volatility, increasing energy independence, increasing diversity in energy supply, improving reliability, increasing energy security, and reducing the impact of energy resources on the environment.

In particular, many States are concerned by recent natural gas price volatility and are looking at options, such as renewable energy, to alleviate this problem. Analyses by government, industry, and environmental interest groups have shown that renewable energy provides a hedge against volatile and escalating gas prices by reducing exposure to gas price risk and slowing the increase in gas prices.

To explore this issue further, this winter NARUC sponsored a two-day conference, entitled "The Natural Gas Crisis: Finding Clean Solutions", to examine State, regional and federal opportunities for increased energy efficiency, renewable resources and clean distributed energy in response to high natural gas prices. The conference explored policy actions that could be implemented to encourage clean and affordable energy resources through State and federal regulatory actions. Conference participants included over a dozen utility regulators, environmental regulators, governors' office representatives, consumer advocates, industry representatives, and environmental advocates.

NARUC believes that States have a central role to play in encouraging a diverse supply of power generation and developing clean power resources. To date, approximately 18 States and the District of Columbia have established some level of renewable portfolio requirements. In addition, 23 States have some form of tax incentive for renewables, 17 States have loan and/or grant programs to provide support for capital projects, and 7 States offer payment programs funded by system benefit charges.

NARUC has not taken a formal position on the necessity for a federal Renewable Portfolio Standard (RPS). However we believe that consistent with any adopted national standards for renewable energy supply, States should be afforded maximum flexibility to structure, apply and supplement standards within the State in a way that best promotes the unique resource, technology and economic goals of each State.

I have, for your information and review, attached an appendix containing a short sample of State RPS programs. Additionally, I would like to bring to your attention a February 2001 report prepared on behalf of NARUC entitled "The Renewables Portfolio Standard—A Practical Guide." This report has been widely used as a resource to governmental, industry, and environmental organizations across the country. The report is aimed at assisting State policy makers and policy analysts in defining the particular goals they seek to achieve with an RPS. With many of these decisions, there is no single "right" approach; rather, the option chosen will depend on the circumstances in each State and the intended goals of policymakers. This report is too lengthy to include with this testimony, however it can be accessed on the NARUC website at: www.naruc.org.

NARUC believes Congress should encourage clean energy resources as a tool to achieve fuel diversity and greater energy security. Additionally, to assist the States in the promotion and expansion of diverse power generation resources, Congress could support policies that would complement State efforts to ensure that Regional Transmission Organizations or other regional bodies have sufficient authority to conduct long term planning for their regions and, working with the States and transmission owners, implement long-term planning that should:

- Take into account fuel diversity including renewables resources;
- Recognize the need for new investment in generation and transmission facilities that provides adequate reserve margins;
- Assure that reliability is not compromised by resource imbalances;
- Recognize environmental and societal risk, and associated costs with benefits;
- Assure adequate resources in all regions of the nation.

Moreover, NARUC believes States are instrumental in moving clean energy policies and technologies forward and should therefore retain authority to impose charges to fund programs that promote renewable energy and other measures, and to implement such programs.

NARUC has urged its member State public utility commissions to consider implementing the Electric Power Research Institute recommendations as stated in the "The Western States Power Crisis: Imperatives and Opportunities" and "The Electricity Enterprise Security Assessment." Specifically, recommendations to "Demonstrate and deploy new generating technologies for the intermediate term and beyond (renewables, advanced coal, fuel cells, and nuclear) to maintain a balanced portfolio of generation options as the backbone of the nation's energy security."

State Commissions are also increasingly interested in an emerging regulatory concept known as of portfolio management. Portfolio management begins with the primary objectives of a utility or default service provider obtaining electricity resources for customers, with the primary goals including reliability, mitigating risk, maintaining customer equity, improving the efficiency of the generation, transmission and distribution system, improving the efficiency of customer end-use consumption, and reduction of environmental impacts and risks. Portfolio management provides a process for utilities to determine and implement the mix of electricity resources that will achieve these objectives to the greatest extent possible.

Portfolio management is wholly consistent with efforts to create competitive wholesale electric markets and offers a structured approach for assembling a diverse mix of short-and long-term energy resources to serve retail customers at regulated rates, via traditional power supplies as well as energy efficiency, distributed generation, demand response, and renewable energy resources. Retail electric customers receiving regulated service can be protected from volatile energy markets by load-serving electric utilities that engage in prudent portfolio management practices. Fourteen environmental and consumer organizations and the National Commission on Energy Policy, have endorsed portfolio management efforts. NARUC encourages State regulatory commissions to explore portfolio management techniques that may be applicable to their particular circumstances, under either traditional or restructured markets, and to adopt appropriate regulatory policies to facilitate effective implementation of portfolio management practices by regulated utilities.

NARUC and its members continue to investigate opportunities to develop research, training, and outreach programs on portfolio management to serve the needs of State commissions and to further develop the regulatory community's knowledge about resource management practices to minimize risk and improve system reli-

ability and market performance. With funding from U.S. Department of Energy, NARUC is exploring the options available to State utility regulators to manage electricity resources in today's diverse regulatory environments. This project will address the role of utility regulators with regard to resource planning and risk management, particularly as they relate to the provision of default and regulated electric utility services.

To kick off this project, NARUC's Committee on Energy Resources and Environment held a workshop on February 12-13, 2005, in Washington, DC, on the subject of Portfolio Management. NARUC assembled a balanced group of economic regulators, State energy officials, utilities, competitive sellers, consumer advocates, environmental advocates, and consultants to address the challenges of implementing portfolio management strategies in the context of today's electricity markets.

In order to encourage the diversification of power generation resources, NARUC believes transmission policies should be developed that ensure that a variety of clean power resources can be interconnected to the electricity grid, while maintaining reliability. NARUC has been actively involved in the Federal Energy Regulatory Commission (FERC) proceedings on generator and small generator interconnection agreements. On March 2, 2005, NARUC filed comments on the FERC Notice of Proposed Rulemaking in the Interconnection for Wind Energy and Other Alternative Technologies Proceeding. NARUC's comments suggested that reliability rules should apply equally to all generation resources, including renewable resources such as wind, if the generator can demonstrate the ability to satisfy equivalent reliability criteria. In addition, NARUC's comments supported balancing the goal of maintaining the reliability of the transmission system with the goal of encouraging interconnection of renewable resources.

Finally, NARUC urges the Congress to approve a five-year renewal of the 1.5 cent per kilowatt-hour (adjusted for inflation) production tax credit for electricity generated from new facilities brought on-line after December 31, 2001, using wind, solar, geothermal, and energy from waste facilities.

Thank you for your attention today and I look forward to answering any questions you may have.

APPENDIX

A SAMPLE OF STATE RPS PROGRAMS

(Please note: this is not a comprehensive review of all State programs, but rather a sampling and is not intended to endorse any particular program.)

Minnesota's Renewable Energy Objective

- The law establishes annual targets for all utilities in the state to supply a small but growing percentage of their electricity from renewable energy resources. (10% by 2015)
- Defined as wind, solar, biomass or low-capacity hydro. In 2003 expanded to include hydrogen and municipal solid waste burning facilities.

Wisconsin

- Wisconsin has a Renewable Portfolio Standard. Increasing standard from 0.05% 2001-2002 to 2.2% in 2011 and beyond.
- They also have a credit trading/tracking Program up and running.
- They have completed rulemaking and have a contract with Clean Power Markets to operate their trading/tracking system.

Iowa has a "Policy" and the Governor has stated a "Goal"

- Iowa State Statute 476.41 provides "It is the policy of this state to encourage the development of alternate energy production facilities and small hydro facilities . . ."
- Governor's goal of 1000 MW of renewable energy by 2010.
 - Tax incentives
 - Green pricing program
 - Net metering rule

North and South Dakota

- Both states rely on voluntary actions by utilities in their states.
- Neither state has defined "renewables" in statutes. Utilities generally define renewables as solar, wind, biomass, geo-thermal and small hydro-electric.

- Both North and South Dakota have strong wind regimes that would facilitate export opportunities to other jurisdictions needing to add renewables to their portfolios.

(ND and SD have legislation proposed which would grant permissive authority to ND Public Service/SD Utilities Commission to participate in regional design and implementation of credit tracking and trading system.)

Pennsylvania

- Energy sources are split into two tiers, Tier 1 being pure renewables such as wind, solar, etc., while Tier 2 includes waste coal, coal gasification, and demand-side management.
- Tier 1 generation starts at 1.5% in 2007 and increments .5% a year to reach 8% by 2020, while Tier 2 must contribute 10% by 2020.
- In the Tier 1 category there is a set-aside percentage requirement for solar generation. The Public Utility Commission will also set up an independent entity to manage an alternative energy credits trading system.

California

- This is a renewable portfolio standard requiring 20% percent of the generation for retail sales be sourced from eligible renewables by 2017.
- Utility cost recovery for renewable purchases comes from two sources; (1) recovery for contract costs up to the market price in retail generation rates, (2) above market costs covered by California's Renewable Resource Trust Fund, a public benefit fund. Above-market costs are paid directly to sellers, not to utilities.
- The California Public Utilities Commission (CPUC) will establish annual procurement targets for each electrical corporation. An initial baseline for these targets will be based on the actual percentage of retail sales procured from eligible renewable energy resources in 2001. The CPUC will then develop a schedule whereby the % renewable requirement increases each year until the requirement reaches a 20% minimum standard for retail generation in 2017. The CPUC must ensure an increase of at least 1% per year.
- The CPUC will also establish market prices for electricity.

Texas

- This is a capacity-based standard to ensure that 2,000 megawatts (MW) of new generating capacity from renewable energy technologies is installed in Texas by 2009, for a cumulative installed renewable capacity of at least 2,880 MW by January 1, 2009.
- The initial goal is 400 MW for 2002. The 2000 MW goal remains constant from 2009 through 2019. New facilities are defined as renewable energy generators placed in service on or after September 1, 1999. The portfolio standard affects all electricity retailers in competitive markets in Texas.

Senator BINGAMAN. Thank you.

Mr. Popowsky.

STATEMENT OF SONNY POPOWSKY, CONSUMER ADVOCATE OF PENNSYLVANIA, HARRISBURG, PA

Mr. POPOWSKY. Thank you, Senator Bingaman, Senator Salazar, Senator Alexander.

My name is Sonny Popowsky. I am the consumer advocate of Pennsylvania. I also serve as a member of the executive committee, and I formerly served as president of the National Association of State Utility Consumer Advocates, or NASUCA. NASUCA's members are authorized, by the laws of our respective jurisdictions, to represent the interests of utility consumers in 42 States and the District of Columbia.

The adequacy, reliability, and cost of electric generation are all matters of paramount importance to electric consumers across the Nation. That is true whether those consumers live in States like Pennsylvania, that have restructured their electric industries to try to bring about competition among generation suppliers, or in States

in which generation continues to be a part of the bundled service provided by vertically integrated monopoly utilities.

In my opinion, the diversification of generation resources is a critical, but often overlooked, element that affects the reliability, adequacy, and cost of our Nation's electric generation supply.

It is also my opinion that market forces, alone, are not likely to bring about the diversification in generation resources that is needed to ensure that our future electricity needs are met in the most reliable and economic manner. Rather, I believe that State and Federal policymakers can take steps to avoid excessive reliance on a particular fuel or type of power plant to meet our future energy needs.

This issue has been illustrated most recently by the headlong rush in the electric industry to build power plants that are fired exclusively by natural gas. The rapid rise in natural gas demand for electric generation has had extremely harmful impacts on both the price of natural gas and the price of electricity. In effect, this has been a double whammy for consumers across the nation, particularly for those who rely on natural gas for home heating purposes.

Reliability of utility service has also been called into question in some areas where demands for natural gas from electric generators during peak cold weather periods have clashed with the demands for more traditional natural gas seasonal usage.

It is in this light, I believe, that one should consider Pennsylvania's decision in 2004 to become one of the most recent States to enact legislation that established a diverse portfolio standard for all generation suppliers. Even though Pennsylvania lies in the heart of PJM, which is generally recognized as the most successful regional competitive wholesale market in the nation, Pennsylvania, like its PJM neighbors, New Jersey and Maryland, has decided that it is necessary to establish mandatory enforceable portfolio standards to produce a diversity of resources, including renewable resources that the competitive wholesale generation market might not provide, or at least might not provide in a timely manner.

In my view, Pennsylvania was correct in establishing portfolio standards. I believe that Pennsylvania consumers will benefit from the hedge that these standards will provide against volatile natural gas and other fossil fuel prices. The inclusion of non-polluting renewable resources in that portfolio also provides a hedge against the potential costs of future environmental regulation, including regulations to address global climate change. If and when this Nation decides to take steps to address global climate change, then I believe consumers in Pennsylvania and the PJM region will be well served by the development of the alternative resources that will have come about as a result of our states moving forward in this manner.

Pennsylvania's legislation, I should note, is actually called an "alternative energy portfolio," because, in addition to typical renewable resources, such as wind and solar, the Pennsylvania legislation contains a second tier of resources, such as waste coal and integrated combined coal gasification technology, that attempt to use Pennsylvania's indigenous resources and address Pennsylvania's particular environmental concerns. Importantly, the two tiers in

the Pennsylvania portfolio standard must each be met independently so that, for example, the requirements for minimum levels of Tier I renewable resources, such as wind and solar, cannot be met by over-compliance from Tier II resources, such as waste coal.

Given our progress in Pennsylvania and other States, the question before this committee is whether a Federal portfolio standard is necessary. The members of NASUCA have not taken a position on this issue, as an organization. My own view, however, is that a Federal portfolio standard should be enacted, as long as it does not block or hinder the ability of States like Pennsylvania to continue their own programs in a manner that best meets their own environmental and economic needs.

For example, a Federal portfolio standard might designate minimum levels for certain types of resources that, for environmental, economic, or national security reasons, should be met on a national basis. But the Federal portfolio standards should not preempt the ability of States to continue a second category or tier of resources that the State believes is important to address that State's own economic and environmental needs.

Finally, I would urge that any Federal portfolio standard include a trading program that will help to reduce the cost of the portfolio requirement by giving generation providers access to low cost solutions on the widest possible geographic and market area.

Thank you.

[The prepared statement of Mr. Popowsky follows:]

PREPARED STATEMENT OF SONNY POPOWSKY, CONSUMER ADVOCATE OF
PENNSYLVANIA

Thank you for the opportunity to speak to you today on the vital issues surrounding the diversification of our Nation's electric generation resources.

My name is Sonny Popowsky. I have served as the Consumer Advocate of Pennsylvania since 1990 and I have worked at the Office of Consumer Advocate since 1979. My Office is statutorily authorized to represent the consumers of Pennsylvania in matters involving their utility rates and service. I also currently serve as a member of the Executive Committee and Electric Committee, and formerly served as President, of the National Association of State Utility Consumer Advocates (NASUCA). NASUCA's members are authorized by the laws of their respective jurisdictions to represent the interests of utility consumers in 42 states and the District of Columbia.

The adequacy, reliability, and cost of electric generation are all matters of paramount importance to electric consumers across the Nation. That is true whether those consumers live in states like Pennsylvania that have restructured their electric industries in order to try to bring about competition among generation suppliers, or in states in which generation continues to be a part of the bundled service provided by vertically integrated monopoly utilities. In my opinion, the diversification of generation resources is a critical, but often overlooked, element that affects the adequacy, reliability and cost of our Nation's electric generation supply.

It is also my opinion that market forces alone are not likely to bring about the diversification in generation resources that is needed to ensure that our future electricity needs are met in the most reliable and economic manner. Rather, I believe that state and federal policymakers can take steps to avoid excessive reliance on a particular fuel or type of power plant to meet our future energy needs.

This issue has been illustrated most recently by the headlong rush in the electric industry to build power plants that are fired exclusively by natural gas. The rapid rise in natural gas demand for electric generation has had extremely harmful impacts on both the price of natural gas and the price of electricity. In effect, this has been a double whammy for consumers across the Nation, particularly for those who rely on natural gas for home heating or industrial processes. Reliability of utility service has also been called into question in some areas, where demands for natural gas from electric generators during peak cold weather periods have clashed with the demands for more traditional natural gas seasonal usage.

While the impact of higher natural gas prices on gas heating customers has been painfully obvious, the impact of high natural gas prices on electricity costs is somewhat more subtle. In the PJM Interconnection, for example, in which most Pennsylvania utilities participate, the wholesale spot price for all energy sold in any given hour is set at a single market clearing price. That market clearing price generally is determined by the cost of operating the most expensive power plant in that hour, which in turn, is largely determined by the cost of fuel at that unit. For many hours of the year, that fuel is increasingly expensive natural gas. The average locational marginal price of energy in the PJM market rose from \$31.60 per megawatt hour in 2002 to \$41.23 in 2003. According to the PJM State of the Market Report for 2003, the impact of increased fuel costs on the average PJM energy price in that year was \$12.63 per megawatt hour. In other words, were it not for the increased price of fuel experienced in 2003, the price of power on PJM would have been approximately \$28.60 per megawatt hour. When this differential is multiplied by the literally hundreds of millions of megawatt hours traded on the PJM market over the course of a year, the impact of fuel price increases on wholesale electric prices can be seen to be enormous.

It is in this light that one should consider the decision by the General Assembly and Governor of Pennsylvania in 2004 to make Pennsylvania the eighteenth state to enact legislation that established a diverse portfolio standard for all generation suppliers who serve the state's retail electricity customers. Even though Pennsylvania lies at the heart of PJM, which is generally recognized as the most successful regional wholesale market in the Nation, Pennsylvania (like its PJM neighbors, New Jersey and Maryland) has decided that it is necessary to establish mandatory, enforceable portfolio standards to produce a diversity of resources, including renewable resources, that the competitive wholesale generation market might not provide. Or at least might not provide in a timely manner.

In my view, Pennsylvania was correct in establishing portfolio standards for future generation. I believe that Pennsylvania consumers will benefit from the "hedge" that these standards will provide against volatile natural gas and other fossil fuel prices. The inclusion of non-polluting renewable resources in that portfolio also provides a hedge against the potential costs of future environmental regulations, including regulations to address global climate change. If and when this Nation decides to take steps to address global climate change, then I believe consumers in Pennsylvania and the PJM region will be well-served by the development of alternative resources that will have come about as a result of our states' moving forward in this manner.

Pennsylvania's legislation, I should note, is actually called an "alternative energy" portfolio standard because, in addition to typical renewable resources such as wind and solar, the Pennsylvania legislation contains a second "tier" of resources such as waste coal and integrated combined coal gasification technology that attempt to use Pennsylvania's indigenous resources and address Pennsylvania's particular environmental concerns. Importantly, the two tiers in the Pennsylvania portfolio standard must each be met independently, so that, for example, the requirements for minimum levels of Tier I renewable resources such as wind and solar cannot be met by overcompliance from Tier II resources such as waste coal.

Given the progress of Pennsylvania and other states in moving forward in this area, one question before this Committee, of course, is whether a federal portfolio standard is either necessary or appropriate. The members of NASUCA have not taken a position on this issue as an organization. My own view, however, is that a federal portfolio standard should be enacted, as long as it does not block or hinder the ability of states like Pennsylvania to continue their own programs in a manner that best meets their own environmental and economic needs. For example, a federal portfolio standard might designate minimum levels for certain types of resources that, for environmental, economic, or national security reasons, should be met on a national basis. But the federal portfolio standards should not preempt the ability of states like Pennsylvania to continue a second category or tier of resources that the state believes is important to address that state's own economic and environmental needs. Many states may not have the unsightly and environmentally harmful mountains of waste coal that mar the Pennsylvania landscape, and I would not suggest the inclusion of waste coal in a federal portfolio standard. But I do think that Pennsylvania and other states should remain free to address this issue and others like it through their own portfolio standards.

Any federal portfolio standard should also be accompanied by a trading program that will produce a liquid market for resource credits among generation providers in different states. Such a market should help to minimize the costs of any portfolio requirements to consumers. This is because generation providers would be able to

achieve the lowest cost solutions to meeting the portfolio requirements over a broader geographic and market area.

I am not suggesting that portfolio standards are the only means for state and federal policymakers to support the diversification of future generation resources. Carefully tailored tax credits and increased research and development funding would undoubtedly assist the establishment of resources that are currently the farthest from commercial development.

Finally, while it is not a topic of this particular hearing, I would like to take this opportunity to implore the members of this Committee and all members of Congress to reject any cuts in the federal Low Income Home Energy Assistance Program (LIHEAP) and instead to increase LIHEAP funding substantially in the coming year. The impact of high natural gas and other home heating fuel prices has been harmful to all consumers, but it has been devastating to low income consumers. The need for greater energy assistance is real and immediate. I urge that, whatever else Congress does with respect to energy legislation in the next several months, that you take steps to ensure that energy assistance programs for our neediest consumers are adequately funded.

Thank you for your attention to this testimony. I would be happy to answer any questions you may have.

Senator BINGAMAN. Thank you very much.

The list I've been given here indicates Senator Domenici, of course, would be first in questions, when he returns, I'm second, Senator Salazar, and then Senator Alexander. So we'll start through 5 minutes of questions for each of us and just go through this list until we run out of questions.

Let me ask about one of the suggestions that I think Senator Domenici made in his opening statement there, and that was that we ought to consider expanding the RPS to include base load generation from nuclear power or from clean coal power, as I understand it, from gasification technology. I know your position and the administration's position is, Secretary Garman, that you're opposed to any kind of renewable portfolio standard. Do you have any particular thoughts about what the impact would be of actually doing something at the Federal level on this much broader set of issues?

Mr. GARMAN. No, sir, I don't. While we, at this point, currently oppose a generation portfolio standard or a market intrusion of that kind, we would be happy to work with this committee, using the resources of the Energy Information Administration, to model particular impacts of what you might have in mind. But, at this point, I don't have a good sense of that. Our past model, that I'm aware of, has been focused on renewable portfolio standards, and we have not modeled, to my knowledge, the impacts of variations on that theme.

Senator BINGAMAN. It strikes me that the renewable portfolio standard was a device that was intended to take a set of technologies and abilities to generate power, which were fairly modest, as far as the overall mix that most utilities have for power generation, and expand that somewhat. That was the idea behind it. It seems to me, for the Federal Government to step in and say, "Okay, we're going to also have, in Federal law, provisions that try to influence the—what utilities nationwide do in this much broader area, to include other—coal gasification, nuclear"—that seems to me to be a substantial expansion of Federal involvement that we haven't seen advocated before. I haven't.

Mr. Morgan, did you have any thoughts on this?

Mr. MORGAN. Yes, I do, Senator Bingaman. It strikes me that the idea of expanding the RPS to include base load technologies, like

nuclear and coal gasification, is really not a very good fit for this particular policy. I think there are some other policies that might be more appropriate for those technologies.

The renewable resources that the RPSs—I guess, was originally conceived to address are—tend to be rather in small increments; whereas, the base load facilities are large, often a few hundred megawatts. And setting up a policy like this, you'd have a problem with very large chunks appearing, you know, at one time, and it—I think it would make it much more complicated, administratively. And you'd have to set the bar much higher if you were going to have any impact at all. You'd have to have a larger percentage. And, as you do that, you wind up almost providing a Federal dictate on how any electricity provider would have to develop a mix of resources. Granted, some of that would be tradable. But I think it—the intent of the RPS, at least as I understand it, is to help some technologies that are available and just need a little bit of a push to make them economically viable. And the idea of using an RPS to try to get a technology that is—really is more in need of a deployment phase, or something like that, just doesn't seem to fit into those particular approach to me very well.

I should qualify that I'm really giving you my own opinion. This isn't something NARUC has taken a position on. But I would expect that a lot of utility regulators would have the same feeling, that if you go beyond, you know, the small percentages that we're talking about here, that starts to sound like a rather large Federal dictate on how we should, you know, procure resources for electricity generation.

Senator BINGAMAN. My time is up, Mr. Chairman. Thank you.

The CHAIRMAN [presiding]. Thank you, Senator Bingaman.

Now, Senator Bingaman, might I just tell you and the committee, I have to leave. I've been scheduled to be at the White House for a number of days, and I can't get out of it. So, Senator Alexander's going to be here. And in the event he would have to leave before you finish, we have an understanding that you could continue the meeting.

Thank you all very much. And we will be familiarized with what you all are saying. We're very interested, or we wouldn't have called the meeting. Thank you for your time.

Senator ALEXANDER [presiding]. Senator Salazar.

Senator SALAZAR. Thank you, Senator Alexander and Senator Bingaman. Thank the members of the panel for your presentation today.

Let me also just acknowledge Wayne Brunetti and your work in Colorado and your efforts on the implementation of Amendment 37. As you know, Amendment 37 is something that we are mutually supportive of in Colorado, and it does create an RPS in Colorado with 10 percent renewable energy required to basically be in place by the year 2015. And I appreciate the public comments of support that you have made, and look forward to seeing that program implemented in the years ahead.

I am a supporter of renewable energy, frankly, because I think it makes sense from an economic point of view, an environmental point of view, and it helps, at least to a small degree, lessen our over-dependence on foreign oil.

I would ask, Mr. Brunetti, for you to just comment to the panel on how it is that we are moving forward with the implementation of Amendment 37 in Colorado, and how your company, that delivers much of the power within our State, is moving forward to try to get to that 10 percent threshold.

And then, while I'm asking—while you're answering that question, I would just ask a second question to Assistant Secretary Garman, so you can be answering it. I want to ask you why it is that what we have done in Colorado—has been done in many States, including Texas and New Mexico—isn't really something that we ought to be doing at a national level. Every time that I have dealt with industry on natural resources and energy issues in my professional life, there's always a sense that industry would rather be subjected to one set of regulatory standards, as opposed to 50 different sets of programs that we establish around our country. And so, it makes sense for us to develop something, from my point of view, that might be able to bring more coherence to what we're doing all across the country, as opposed to leaving many of the RPS standards to be pushed by initiated measures, where we're going to have 50 different sets of programs within each one of the 50 States.

So, Wayne, if you will answer my question first, and then perhaps Secretary Garman.

Mr. BRUNETTI. Thank you, Senator.

For the committee's information, Amendment 37 was a ballot initiative that was passed in November in Colorado that mandated a renewable standard. The legislature in Colorado, for the past almost 3 years now, has been dealing with a renewable portfolio standard which our company has supported. We've found ourselves in an awkward position of opposing Amendment 37, because it had some poorly drafted language. That's the only reason.

We have since, with the help of the environmental community, passed through committee some amendments to that Amendment 37 which will make it, certainly, easier to implement, but doesn't change the standard, itself, in Colorado.

We have also announced, in Colorado, that we went out with an RFP for 500 megawatts. Because the production tax credit has a limitation by the end of this year, we were not able to secure enough resources to be in production by the end of the year. We've tailored that back. Hopefully—and I encourage Congress, please, to extend this over a longer period of time, because it takes time to site—get the developers in there, site these facilities; and, with a short window, it's very difficult. But we will meet that standard there, as well as four other states that we serve that have renewable standards in it.

Senator SALAZAR. Mr. Brunetti, is it, in your mind, being an expert in electrical generation, feasible to do what we're doing in Colorado in other states across the country?

Mr. BRUNETTI. Not the same kind of program, no. It would not work. One of the reasons I put that chart up is because you have to look at the resources available, by region. For instance, if we had a standard like that in the Southeast, I don't—if I was running a utility in the Southeast, I wouldn't know how to go about implementing it, at all, unless you expand—broadly expand the defini-

tion of what a renewable resource is. And that's what I suggest by my written testimony. But you have to expand it, because they just don't have the availability for wind, and even solar, if you look at the solar charts on it, it's just not there.

Where we serve—Colorado, the Dakotas, Minnesota, Texas, and New Mexico—there's great resources available. So we can take advantage of that, but I don't know how some of my colleagues could ever do that, without expanding the definition.

I just want to make one comment. I think—let's think about this from a business point of view. What problem are we trying to solve? And is it a security problem? Is it an environmental problem? Or, as was suggested, is it to help technologies develop? I would say—I would lean toward the first two, it's—environmental and energy security is what the policy should concentrate on.

Senator SALAZAR. Secretary Garman.

Mr. GARMAN. Thank you, Senator Salazar.

And my answer to that question largely follows on the heels of what my colleague here said. As this map illustrates, the distribution of renewable resources across the country is very uneven. And a single "one size fits all" federally-mandated standard would tend to create winners and losers, if you will, or wealth transfers. There are ways you can try to design a national standard to diminish those impacts; but, in general, the winners would be the regions that have ample renewable energy resources, and the losers would be those regions without. And, inevitably, you'd have some kind of trading mechanism where funds would flow from those that have—or from those that don't—to those who have. It's the short answer.

Senator SALAZAR. If I may—I know my time is up, but just to push you a little bit on that question—the reality of it is that, in the same way that Amendment 37 has happened and the same way that we have an RPS in Texas and in many of these other States, inevitably, I think what we're going to see across this country is going to be the phenomenon where groups are going to get together, they're going to put these measures on the ballot, they're going to push legislatures to move them forward. So you're going to have programs that are like Amendment 37 in most of our States around the country, but each one of them is going to be different.

Could we craft something that would be a Federal RPS that would provide the kind of flexibility within it that would recognize the diversity of renewable sources from region to region or from State to State?

Put it this way, if I were in Wayne Brunetti's shoes, and I was the CEO of his company, and I knew that I had to comply with one RPS out of Colorado and another one out of Texas and another one out of any of the other States that he works in, it would cause me some difficulty, I think, in terms of managing my compliance with these multiple RPS standards.

Mr. GARMAN. That would be true, but retail electricity sales are largely regulated at the State level today, so he's already having to deal with a multiplicity of State regulators. So I don't know that this gains him a whole lot. But I would let him answer that on his own.

Senator SALAZAR. Thank you.

Senator ALEXANDER. Thank you, Senator.

I guess it's my turn to ask questions, and then we'll go to Senator Bingaman.

Excuse me for missing the first part of your testimony. And I want to ask a couple of questions about wind. And, if you'll excuse me, I'm going to jump ahead a little bit.

Mr. Bowers, who will testify next, has a map that's over there, about wind generation potential in the United States. And, in his testimony, he says that in the Southeastern United States they lack wind—sufficient wind speeds to support commercially viable wind generation, except for isolated mountain ridgetops, as shown in figure 3.

Now, those isolated mountain ridgetops, as shown in figure 3, include a general area that we might call the Great Smoky Mountains National Park and the Cherokee National Forest, which is the most visited national park in the United States, by a factor of three. Ten million people a year come there, as opposed to three million in Yellowstone.

And I was trying to get a picture in my mind of what the Smokies and the foothills would look like with these wind turbines spread all around. Has anyone given any thought to what a renewable fuel standard that gave incentives, along with tax credits, to wind farms is likely to do to the American landscape? And has anyone thought about whether Congress should consider putting off limits certain parts of our landscape so that we could actually see the mountains? Most people from Ohio who drive down to the Smokies don't drive down there to see windmills or water slides or even cell towers. They drive down to see the Great Smokies. And if I'm not mistaken, these wind turbines are taller than football fields and can be seen for miles away.

So I'll get to ask Mr. Bowers about that; I'm just wondering if, in the discussion of renewable fuel standards, there might be the unintended consequence of having Americans wake up 10 years from now and find thousands of these football-field-tall wind turbines in their backyards and front yards and in front of their mountains, and whether anyone is thinking about that or trying to put that in some perspective.

Mr. Brunetti, do you have any thoughts about that?

Mr. BRUNETTI. I sure do, because, if you look at this map, the best wind in the United States is on the Continental Divide, which goes through Colorado and up the whole West. And it just comes down to the very practical, Senator, that you could never permit it. I mean, we could never permit it. We have seen citizens groups—in Wisconsin, there's a group that's called COW. It stands for Citizens Opposed to Wind, for visual reasons. There has been a Citizens Opposed to Wind in Kansas; and, as you probably know, in the Northeast, a coastal siting of wind generators offshore have raised some protests.

So it comes down to some practical—any resource has its own unique set of problems. And siting usually takes care of it. I think, from a practical standpoint, we know that we could never try to permit something on the Continental Divide.

Senator ALEXANDER. Yeah. Before my time is up, if I could give a—I've got a picture there, just to—I think one of the things, as

we think about renewable resources—and then I'll go to Senator Bingaman—is to be realistic. And I've tried to equate, for example, what one gas rig produces with how many wind turbines it would take to equal it. And I believe I'm correct that one gas rig offshore, which could be so far out that no one could see it, might produce enough energy for 500 megawatts, more or less. And, if I'm right, that—if each wind turbine is one megawatt, or a little more, that would be about 450 or so wind turbines. That's 46 square miles of wind turbines. Or, if you wanted to compare it to a single gas plant or a nuclear power plant, 1,000 or 1,100 megawatt plant, then that's a 1,000 or 800 or 900 wind turbines. And that's 100 square miles of these, which can be seen for 5, 6, 7, 8, 10 miles away.

We are having a very emotional debate in the U.S. Senate, or will have, about whether we should drill for oil in a 3 square mile area of the Alaska—of ANWR, in Alaska. And there is great testimony about how that scars that landscape, in an area where very few people will ever see it; yet we're just blithely going on, it seems to me, imposing Federal requirements that might have the unintended consequence of—and many State requirements—of producing thousands and thousands and thousands of—literally square miles of wind turbines, which produce, in the end, relatively little energy.

I'd like to come back to that in my question, because my time is up, but my objective is to try to make sure we introduce some realism into the debate about energy and to make certain that, if we're talking about mandated green requirements, that we understand—we're not—may not be talking about just more fields of corn; we might be talking about something that's going to be permanently on the landscape.

Senator Bingaman.

Senator BINGAMAN. Mr. Chairman, I didn't have any additional questions for this panel.

Senator ALEXANDER. Senator Salazar.

Senator SALAZAR. Yes. This is just for any member of the panel who would wish to comment on this. But, as we talked about these renewable energy sources and the different kinds of renewable energy that are out there—solar, wind, biomass—do a couple of you want to take a stab at giving, to me and to the members of the panel, which ones of those are the most promising to pursue?

I think the administration should go first.

Mr. GARMAN. Yes, sir. And, as you know, your State is home to the National Renewable Energy Laboratory, where many of these technologies are under development, we're quite excited about the potential of a number of them.

Wind has tremendous potential. And one of the things we're looking at to ameliorate the concerns of Senator Alexander and others who are concerned about the aesthetic impact of wind turbines on hilltops, is to develop new wind turbine designs—and this work is underway at the National Renewable Energy Lab—to allow wind turbines to be placed in areas of the country with lower wind speeds. And this is a long-term effort. We'll still have aesthetic issues, because these turbines will be even larger than the turbines we have today. But if they can be placed in a less sensitive spot,

where aesthetics are less of a concern, then wind has tremendous potential.

We also think that wind has tremendous potential offshore, perhaps even in some areas of the country out of sight of the shoreline, so that the electricity can be generated, but without the visual impact. And we think that has tremendous potential, particularly in the Northeastern United States, where electricity prices are quite high and there is a tremendous wind resource offshore, much of it in shallow water, where we can place wind turbines and send that power to shore.

And, similarly, I'm bullish on the long-term prospects of solar. If we are successful in our target of developing 6 cent/kWh electricity by 2020, which is what we're working on at that lab in Golden, Colorado—if we're successful, then I don't know that we'll have to have a lot of discussions about renewable portfolio standards or other mandates to force people into a behavior; I think people will be choosing renewable energy because it's the cheapest source available to them by that time.

So, those are our hopes. That's what we're bullish on. That's what our R&D program is targeted for. And we're grateful for the support that we've received for that program from this committee, and the Congress, as a whole.

Senator SALAZAR. Where are you with respect to ethanol and biomass energy?

Mr. GARMAN. Ethanol, again, has potential if we start to think beyond the ethanol that we derive from corn. We generate about, I believe, 3.4 billion gallons of ethanol a year from corn, but we use 135 billion gallons of gasoline. We can't offset a lot of petroleum with ethanol from corn. However, if we are successful in bringing down the cost of ethanol derived from cellulosic materials and other waste products, such as corn stover, rice straw, wheat straw, other things that would normally be left in the field or thrown away, even some forms of municipal solid waste, if we're successful in doing that—and that work is also underway at the National Renewable Energy Lab—then we could make a sizable dent—say, 40, 50 billion gallons a year—in our gasoline use.

Senator SALAZAR. I would ask your continued support of NREL in Colorado, because I do think it is one of the facilities that has great promise for showing us a future that we need to find.

My time is not quite yet up, but does anybody have any other thoughts, in terms of what that portfolio of renewable energy sources should be, in terms of the possibility of any of the different components that David Garman spoke about?

Mr. BRUNETTI. Senator, from a practical standpoint, we have to, once again, look at what surrounds you and what's available to you. And, from our perspective, wind is—in those States that we serve, is the number one source. And one of the issues with wind is that, where the wind blows, there's no load, so transmission is an incredible—an important issue. That was part of the energy bill, dealing with the transmission issue. I encourage you to keep that in the energy bill, viability—building more transmission—encouraging more transmission.

But besides wind in our portfolio, conservation is a big part of our program approach to dealing with environment—particular en-

vironmental issues. And load control is also a very important part of our particular portfolio, particularly in Minnesota, growing in Colorado, not so much in the southern—the states that we serve.

We've tried some other programmed approaches. They're not at the economic point now. We work—I had my whole team down to NREL about 2 months ago, looking at some different program approaches. I also encourage Congress to keep supporting NREL, because it's a terrific lab.

Senator SALAZAR. Thank you.

Senator ALEXANDER. Thank you, Senator Salazar.

I have a series of questions that Senator Domenici wanted to be answered, and I'm going to ask the staff to submit those to you and ask you, if you would like to comment on them, to please do, because it'll be a full part of our record, and we'll play close attention to it.

I'm going to ask just a couple of those questions of any of the witnesses, and then we'll wrap up this panel and go on to the next.

First question is, If there were a national power generation diversity standard, should credits offered under a State program also count toward fulfillment of any Federal obligations? Any comment?

Mr. Brunetti.

Mr. BRUNETTI. The answer is yes. I mean, you have to preserve what the States have done. A lot of States have moved forward with their programs, and I think it's very important that you don't destroy what the states have done.

Senator ALEXANDER. Mr. Popowsky.

Mr. POPOWSKY. Yes, I would agree. In Pennsylvania, as I said, we have moved forward with a standard. I think some of the things that are included in our renewable portfolio standard may not be particularly relevant to the rest of the Nation, things like coal waste that we have. But what our utilities and other generation suppliers do in Pennsylvania, I think they should be given credit for, on a national basis, as well.

Senator ALEXANDER. Well, if a multi-tiered approach like the Pennsylvania model were to be used in a national power diversity standard, what kinds of resources ought to be included? And should there be different levels of credit for different classes of resources?

Mr. POPOWSKY. One of the things—just speaking for Pennsylvania, one of the things that we've found is that, we do have some unique environmental problems in Pennsylvania. We have these giant mounds of coal waste that we have to get rid of. And it's really hard for me to see that that would be included in a national standard. I think that there are certain resources that I believe, for national security, for environmental, for economic reasons, you probably would want to include in a national standard; and others, I would think that individual States may be able to pursue separately through their own separate tier.

Mr. MORGAN. Senator, if I could, I'd like to just add my voice, saying, absolutely, the Federal standard should essentially overlap with any State requirements that are there already that one resource could fulfill both at the same time; otherwise, it's seems like the cost would certainly be out of hand. And I think most people here would agree that that would really be untenable.

In the District of Columbia, we're actually the newest district to have an RPS. It was just passed at the end of last year, after Pennsylvania's. And if there were a Federal standard, I think it would probably wind up, sort of, trumping what we've done already, and I wouldn't have any problem with that, you know, with basically meeting the Federal standard at the same time. I think that would be the efficient way to do it.

Senator ALEXANDER. And on that, as a follow-up, if there were a national power generation diversity standard with requirements of up to 10 percent diverse resources, how important would tax credits still be to a project's ability to be financed? Any comment on the importance of tax credits?

Mr. Brunetti.

Mr. BRUNETTI. Once again, I think this is a consumer issue that—development of particular types of renewable energy—with-out the tax credit, the price tag to consumers would be unbearable, and particularly with, as has been mentioned, the run-up in natural gas prices. I mean, consumers are really hurting from that today. So it's really important that we—we can now price point, for instance, wind to match natural gas. And it competes very well with natural gas—with the tax credit; without it, the consumers would pay a price tag that I think—the question is, What's the tolerance level for consumers? And particularly with this run-up in natural gas, I think we've reached the complaint point, from a CEO's point of view, that's becoming intolerable.

Senator ALEXANDER. Anyone else?

Well, I want to thank each of you for coming and for making your contribution. And we'll submit the questions to you and look forward to your responses.

We'll now invite the second panel to come forward.

Senator ALEXANDER. Thank you for being here. I'm going to introduce each of you now, and then ask you just to proceed with your testimony. If you could summarize your remarks in about 5 minutes, and Senator Salazar and I will ask questions. As other Senators come in and out, we would give them a chance to do the same. Senator Salazar, I'll let you have the first questions, when we get to that.

Don Furman is here, senior vice president, regulation and external affairs, PacifiCorp, Portland, Oregon. Welcome. Thank you very much. Kerry Bowers, who's manager of customer technologies, research and environmental policy department for Southern Company, in Birmingham. I already used your map. I hope you'll—you don't mind my doing that. Alan Nogee is director of Clean Energy Program, Union of Concerned Scientists, in Cambridge, Massachusetts. Welcome. And Brian O'Shaughnessy, president and CEO of Revere Copper Products, Rome, New York, on behalf of the National Association of Manufacturers.

Why don't we just start with you, Mr. Furman, and then we'll go right down the row.

Thank you.

STATEMENT OF DONALD N. FURMAN, SENIOR VICE PRESIDENT, REGULATION AND EXTERNAL AFFAIRS, PACIFICORP, PORTLAND, OR

Mr. FURMAN. Thank you for the opportunity to appear before you today.

As you said, I'm Don Furman. I'm senior vice president of regulation and external affairs at PacifiCorp, which is a company with 1.6 million electric customers in six Western States. We mainly rely on coal—a combination of coal and hydropower to serve our customers. And, as a result, we have some of the lowest rates in the Nation.

The purpose of my testimony is to urge the Congress to enact national renewable portfolio standard legislation. PacifiCorp believes a well crafted national RPS will spur the development of renewable electric generation resources nationally, over both the short and the long term, in a manner that is most cost effective to electric consumers.

Specifically, PacifiCorp supports an RPS that sets reasonably ambitious targets for the next 15 years, maximizes the efficiency for power suppliers by permitting the trading of renewable energy credits, and caps costs to suppliers and consumers.

Although renewable generation outside of hydro is but a small part of our current resource mix, we believe that renewable energy, with the appropriate government incentives, can and should play a greater role in each utility's generation portfolio.

PacifiCorp believes a national RPS offers a sensible route to portfolio diversification that is low cost and low risk to consumers. And we base this conclusion on several considerations.

The first one is, portfolio diversification is in the national interest. Emphasis on "national." With so much of the upward pressure on natural gas demand coming from electric generation, it is important for the electric sector, and the economy in general, to reverse this trend. Renewable energy can make a substantial contribution to generation diversity. Reducing the demand on gas will also reduce the upward pressure on prices. An RPS could help reduce natural gas costs by billions of dollars.

Second, a national RPS is needed to address the policy patchwork emerging across the States. And this is a problem that we, in particular, have with six different States regulating us. While state RPS laws contribute to the worthy goal of driving resource portfolio diversification, a State-by-State approach will never achieve the real efficiencies offered by a flexible national policy, and could be extremely troublesome to utilities that operate in more than one State. Federal and State policy can achieve an appropriate balance of consistency and flexibility by establishing a national standard and giving States the ability to set policies exceeding the national standard, but without limiting how their power supplies meet the Federal standard.

Third consideration is the policy—is, the current policy of stimulating renewable generation development through tax incentives is unpredictable and not sustainable. And, for us, it's simply not working. The lack of certainty around the availability of the renewable production tax credit has hampered utilities seeking to acquire renewable resources. There is no question that, over the short term

at least, the renewable PTC is vital to making many renewable projects economically viable; but the inability of developers and producers and, for that matter, the utilities who are relying on developers and producers, to know, with confidence, when the credit will be available, if it is available at all, has stalled renewable energy development. Enacting a national RPS that establishes long-term portfolio diversification objectives will give developers and utilities a longer timeframe to plan, site, procure, develop, and operate renewable generation.

Fourth, and last, an RPS would deliver a range of benefits to consumers and the environment, establishing a national system of tradable renewable energy credits, would maximize cost efficiency. It would essentially be a market response, as opposed to just a simple subsidy, which is what the tax incentive does.

A cap on compliance costs may also be built into the national policy to ensure minimal effect on consumers. Overall consumer costs could actually decline due to the reduction of natural gas prices, as Dr. Wiser pointed out in the last panel, resulting from greater development of renewable generation.

Furthermore, by adding a significant amount of new renewable energy generating capacity, utilities will be able to reduce the risk of compliance with any future limits on carbon dioxide emissions. This is an issue particularly important to my company, because we are so reliant on coal, at the current time.

Mr. Chairman, PacifiCorp recognizes the interest in expanding the portfolio standard approach beyond renewable energy to include other technologies, such as clean coal and nuclear power. It is important to spur the development of a diverse base of technologies and fuel sources. PacifiCorp, for example, is exploring the addition of an Integrated Gasification Combined Cycle, IGCC, coal plant to our resource mix. We're very excited about the potential, both in terms of the technology, but also in terms of the developing commercial arrangements that we think are possible with this sort of technology.

Expanding a national portfolio diversification policy beyond renewables, though, should be approached carefully for some of the reasons that were mentioned in response to questions in the earlier panel. The inclusion of these large-scale, longer-term technologies should not come at the expense of maintaining incentives for renewable energy development. And, I guess, to summarize that point, it is that we ought to be doing both things; we ought not necessarily be linking them into the same exact tool that we use, which is a portfolio standard.

In summary, PacifiCorp believes that renewable development will best be achieved through a combination of tax incentives and resource portfolio targets over the short term. For the long term, PacifiCorp supports establishment of a reasonable set of national standards that increases the share of renewable generation in all power supply portfolios.

Mr. Chairman, that concludes my prepared presentation. I'd be happy to respond to questions.

Thank you.

[The prepared statement of Mr. Furman follows:]

PREPARED STATEMENT OF DONALD N. FURMAN, SENIOR VICE PRESIDENT,
REGULATION AND EXTERNAL AFFAIRS, PACIFICORP, PORTLAND, OR

Mr. Chairman and members of the Committee, thank you for the opportunity to appear before you today. My name is Donald N. Furman. I am Senior Vice President of Regulation and External Affairs for PacifiCorp, a company with 1.6 million retail electric customers in six western states.

The purpose of my testimony is to urge the Congress to enact national renewable portfolio standard (RPS) legislation. PacifiCorp believes a well-crafted national RPS will spur the development of renewable electric generation resources nationally over both the short-and the long-term in a manner that is most cost-effective to electric consumers. Specifically, PacifiCorp supports a RPS that sets reasonably ambitious targets for the next 15 years, maximizes efficiency for power suppliers by permitting the trading of renewable energy credits, and caps costs to suppliers and customers.

Today, a large portion of PacifiCorp's power supply portfolio is comprised of base-line coal generation. We also own and operate natural gas, hydroelectric, and a small set of wind and geothermal generating facilities, and we purchase power from other utilities, independent power producers, PURPA qualifying facilities and marketers. PacifiCorp's Integrated Resource Plan (IRP) projects substantial increases in demand for electricity from our customers and calls for the addition of thermal (both gas and coal) generating capacity, increased demand-side management and conservation programs and the procurement of 1,400 megawatts of renewable generating capacity (primarily wind) over the next ten years.

The selection of such a substantial amount of renewable energy in our IRP analysis documents that renewables—with the appropriate government incentives—can and should play a greater role in utilities' generation supply portfolio. PacifiCorp believes a national RPS offers a sensible route to portfolio diversification that is low-cost and low-risk to consumers. We base this conclusion on several considerations:

1. Portfolio diversification is in the national interest. This Committee has taken an in-depth look at the supply and demand challenges facing natural gas in the United States. With so much of the upward pressure on natural gas demand coming from electric generation, it is important for the electric sector and the economy in general to reverse this trend. According to the National Petroleum Council, North American natural gas production will satisfy only 75% of domestic demand by 2025. The greatest increase in the demand for natural gas is attributable to the electric generation sector. If we don't act to enhance the diversity of our electric generation fuel mix, we will be forced to substantially increase gas imports. Unlike most thermal and nuclear plants, renewable energy facilities, especially wind generation, may be constructed and placed in service relatively quickly—making an immediate contribution to generation diversity.

Reducing the demand for gas will also reduce the upward pressure on prices. A recently released paper prepared by the Lawrence Berkeley National Laboratory entitled: "Reducing National Gas Prices through Increased Deployment of Renewable Energy and Energy Efficiency", analyzed fifteen studies examining the impact of a national RPS on gas prices. These studies all concluded that a RPS will reduce natural gas costs by billions—nine of the fifteen studies predict savings in the \$10-\$40 billion range by 2020. The Energy Information Administration has on several occasions examined the impact of federal RPS proposals and concluded that the small increase in electricity costs would be offset by the reductions in gas prices.

2. A policy patchwork is emerging across the states. Eighteen states and the District of Columbia have adopted renewable portfolio standards. Several others have a RPS under active consideration. While these laws contribute to the worthy goal of driving resource portfolio diversification, these state-by-state approaches will never achieve the real efficiencies offered by a flexible national policy and could be extremely troublesome to utilities that operate in more than one state. For example, some states make certain technologies eligible for their RPS policy that others do not. Some count only renewable energy that is generated inside their state boundaries even though so much electricity is bought and sold in interstate markets. Some states may allow credit trading while others may restrict it or prohibit it altogether. For multi-state utilities, a series of inconsistent requirements and regulatory frameworks will make planning, building and acquiring generating capacity on a multi-state basis confusing and contradictory. Federal and state policy can achieve an appropriate balance of consistency and flexibility by establishing a national standard and giving states the ability to set policies exceeding the national standard but without limiting how their power suppliers meet the federal standard.

3. The current policy of stimulating renewable generation development through tax incentives is unpredictable and not sustainable. PacifiCorp has issued procurement solicitations for renewable resources to meet our IRP targets over the next several

years. But the lack of certainty around the availability of the renewable production tax credit has hampered our ability to meet these targets. There is no question that over the short term, at least, the renewable PTC is vital to making many renewable projects economically viable. But the inability of developers and purchasers to know with confidence when the credit will be available—if it is available at all—has stalled renewable energy development, created supply scarcity for turbines, towers, related equipment, and skilled labor, and ultimately raised development costs.

Consequently, PacifiCorp strongly encourages the Congress to adopt a two-track approach to promoting development of renewable energy. Enacting a national RPS that establishes long-term portfolio diversification objectives will give developers and utilities a longer time frame to plan, site, procure, develop, and operate renewable generation. In the near term, extension of the renewable energy production tax credit is essential to the continued development of renewable generation resources, however, until meaningful RPS targets kick in.

4. A market-driven RPS policy would deliver a range of benefits to consumers and the environment. Establishing a national system of tradable renewable energy credits would maximize cost-efficiency. A cap on compliance costs may also be built into the national policy to ensure minimal effect on consumers. Overall consumer costs could actually decline due to the reduction of natural gas prices resulting from greater deployment of renewable generation.

By adding a significant amount of new renewable energy generating capacity, utilities will be able to reduce the risk of compliance with any future limits on carbon dioxide emissions. For utilities with growing customer demand, this risk-reduction element is a particularly important.

Mr. Chairman, PacifiCorp recognizes the interest in expanding the portfolio standard approach beyond renewable energy to include other technologies, such as clean coal and nuclear power. It is important to spur the development of a diverse base of technologies and fuel sources. PacifiCorp, for instance, is exploring the addition of an Integrated Gasification Combined Cycle (IGCC) coal plant to our resource mix.

Expanding a national portfolio diversification policy beyond renewables should be approached carefully. Including the significantly larger (in terms of both generating capacity and actual output) size of coal and nuclear facilities would warrant a reconsideration of the targets and timeframes of the RPS proposals that have been introduced in previous sessions. And the inclusion of these large-scale, longer-term technologies should not come at the expense of maintaining incentives for renewable energy development. If Congress desires to expand a portfolio standard requirement to include technologies beyond non-hydro renewable energy, it may be wise to establish separate tiers for renewable and non-renewable sources.

In summary, PacifiCorp believes renewable generation resources are moving closer to economic viability such that they will become a growing part of many utilities' resource portfolios over the next two decades. Renewable energy development will best be achieved through a combination of tax incentives and resource portfolio targets over the short term. For the long term, PacifiCorp supports establishment of reasonable, economically viable standards that increase the share of renewable generation in all power supply portfolios.

Mr. Chairman, this concludes my prepared presentation. I am happy to respond to any questions you and members of the Committee may have.

Senator ALEXANDER. Thank you, Mr. Furman.

Mr. Bowers.

**STATEMENT OF KERRY H. BOWERS, TECHNOLOGY MANAGER,
SOUTHERN COMPANY, BIRMINGHAM, AL**

Mr. BOWERS. Well, good afternoon, Senator Alexander and Senator Salazar.

My name is Kerry Bowers, and I am a technology manager for Southern Company. I am responsible for evaluating emerging technologies related to the generation, delivery, and end use of electric energy. It's my pleasure to present our views on renewable energy to you this afternoon.

Southern Company operates over 39,000 megawatts of electric generation using a diverse fuel portfolio that includes coal, nuclear,

natural gas, and hydro. We provide low-cost electric energy to over ten million people in the Southeastern United States.

We support the development and use of cost effective renewable energy resources. The Southeast lacks sufficient resources from which to cost-effectively generate the amount of energy that a renewable mandate would require. Therefore, Southern Company does not support a mandatory renewable portfolio standard.

I will address the major options for utility-scale renewable power generation—hydroelectric, solar, wind, and biomass—and comment on the ability to use these resources cost effectively in the Southeast.

Southern Company obtains about 4 percent of our annual energy output from the 2,400 megawatts of existing hydro capacity. This renewable resource continues to serve an important role in our generating mix, providing a low-cost means of energy storage that helps us meet peak demands on our system.

Solar energy is less available in the Southeast. This chart that's provided shows solar energy reaching the Earth's surface is highest in the Southwest, as indicated by the dark red colors. Solar energy in the Southeast is represented by the lighter greens and yellows, and is about one-half that amount observed in the Southwest. We have tested solar technologies in the Southeast, and we've concluded that solar generation will be prohibitively expensive in our region, and is not practical as a utility-scale power generation.

We have also evaluated wind resources. The second chart—it's already been referred to today—shows how wind resources vary across the country from class one to class seven, with class four or higher being required for cost-effective wind generation. The purple color shows that, except for the few isolated mountain ridges, the Southeast lacks sufficient wind speeds to support commercially viable wind generation. Consequently, our assessment is that wind energy is not commercially viable in the Southeast, and could not support a mandated renewables portfolio at any significant level.

Biomass resources are available in the Southeast. We have been evaluating the co-firing of forestry wood wastes and agricultural crops in our existing coal-fired generating plants, and we have proven that biomass can be successfully co-fired with coal. However, our testing concludes that co-firing will be limited to about 5 percent of the energy input to a coal-fired plant. Moreover, the ash residue left from combusting biomass will have a negative impact on the technologies being used to reduce nitrogen-oxide emissions from coal plants; thereby, offsetting a major environmental benefit. Thus, we do not plan widespread use of biomass co-firing technology in Southern's fleet of generating plants.

However, there is an alternative approach to using biomass for power generation. It may be possible to apply gasification technology to biomass to form a synthetic fuel gas. Southern Company has extensive experience with coal gasification, having worked with the U.S. Department of Energy for over 10 years to develop this technology. We've recently initiated R&D efforts in our company to apply our knowledge of gasification to biomass. This R&D program is in its initial stages and will require several years of technology development to prove commercial viability. Pressurized biomass

gasification has the potential to be a cost-effective utility-scale renewable option in the Southeast, and we are pursuing it.

In summary, Southern Company has a long history of utilization of renewable energy. Not every renewable technology will be well suited to every region of the country. Hydro is available in the Southeast, and we use it. Solar and wind are not commercially viable renewable technologies for the Southeast. Some biomass is possible, but continued research and development will be needed to estimate its long-term potential.

We are concerned about a “one size fits all” mandate that would require us to use more costly renewable resources or to pay penalties so that renewable technologies can be built elsewhere; thereby, increasing costs to our customers.

We continue to seek cost-effective additions to our generation portfolio based on technology maturity, technical performance, and economic viability. We will continue to work to facilitate generation technology options, including coal, nuclear, natural gas, and renewable energy options that ensures a reliable, affordable, and environmentally sound supply of energy to meet the growing demands for electric power in our region.

Thank you for the opportunity comment, and I'll be happy to address any questions you have.

[The prepared statement of Mr. Bowers follows:]

PREPARED STATEMENT OF KERRY W. BOWERS, TECHNOLOGY MANAGER,
SOUTHERN COMPANY, BIRMINGHAM, AL

RENEWABLE ENERGY OPTIONS FOR THE SOUTHEASTERN UNITED STATES

INTRODUCTION

My name is Kerry Bowers and I am a Technology Manager for Southern Company responsible for the assessment of emerging technologies in generation, transmission, distribution and end-use of electric energy. I am a Chemical Engineer by training and I have over 25 years of experience in the energy industry in technology assessment and evaluation. I am testifying today concerning Southern Company's experience with and outlook for renewable energy options in the Southeastern United States.

Southern Company supports the use of cost-effective renewable energy. Southern Company operates over 39,000 MW of electric generating capacity—including more than 8,000 MW of non-emitting hydro and nuclear capacity—to provide low-cost electric energy to over 10 million people in the Southeast. We continually assess renewable generation technologies available to augment our generation portfolio. I will address the major options for utility-scale renewable power generation—hydroelectric, solar, wind, and biomass—and provides comments on the ability to use these resources in the Southeast.

HYDROELECTRIC GENERATION

Southern Company has operated hydroelectric plants for over 70 years. We have 2,400 MW of hydro which supplies about 4% of our annual energy output. Hydro continues to serve an important role in our generating mix, providing a low-cost means of energy storage that helps us meet peak demands on our system. We have identified up to 125 MW of incremental renewable hydroelectric generation that could be obtained from enhancing existing hydro facilities with advanced technologies.

SOLAR GENERATION

The amount of solar energy reaching the earth's surface in the Southeast is approximately one-half that observed in the southwestern U.S. due to variable cloud cover and humidity levels in the South that diffuse solar energy and reduce its in-

tensity. Figure 1* below indicates where solar insolation levels are highest in the United States.

This reduced insolation level—compared to more favorable Southwest locations, clearly reduces the amount of usable electricity that can be generated from solar technologies in the Southeast. Moreover, there is obviously no solar generation possible at night which accounts for over one-half of the year. In addition, early morning and late evening solar intensities are reduced, although tracking systems attempt to compensate. Southern Company has evaluated numerous solar options over the past 20 years, including operation of thermal solar collectors, Solar Dish/Stirling technology, and photovoltaic arrays of the types shown in Figure 2.

These technology evaluations were performed at the Georgia Power operated Shenandoah Solar Center. In addition, Georgia Power, Georgia Institute of Technology and the U.S. Department of Energy installed a 340 kW photovoltaic roof-top generating system on the roof of the Georgia Tech Natatorium used as the Swimming Venue for the 1996 Summer Olympic Games in Atlanta. Southern Company has monitored the energy production from this facility—which at the time it was completed was the largest roof-top solar PV array in the world. The data derived from these technology evaluations, coupled with the moderate amounts of solar insolation in the Southeast along with concerns over intermittency have lead us to conclude that solar energy will be expensive in our region and not practical as a utility-scale power generation option.

WIND GENERATION

Wind generation technology continues to evolve and Southern Company is evaluating installations by other utilities closely. Wind resource evaluations performed by the NREL and others conclude that the Southeastern U.S. lacks sufficient wind speeds to support commercially viable wind generation except for isolated mountain ridge tops, as shown in Figure 3.

Mountain ridge-top locations are remote, requiring incremental costs for developing access roads and power transmission infrastructure. Moreover, the hilly terrain increases the complexity of installation and the overall costs of wind energy due to variations in wind flows observed in mountainous regions compared to flatter landscapes. This variation is depicted in Figure 6, below which illustrates the variable directional wind flow that can exist in mountainous areas. This variation tends to decrease the amount of usable energy that can be extracted from the wind, resulting in lower capacity factors. Reduced capacity factors increase overall cost per kilowatt-hour of energy generated.

Use of mountain ridge tops is of additional concern in the Southeast due to concerns over land use for aesthetic reasons. Southeastern mountain locations are enjoyed for recreation by a large percentage of the public. Scenic vistas are important and Southern Company considers that there would be a considerable public resistance to the use of mountainous areas for the location of wind farms in the Southeast.

In addition, the intermittency and uncertainty of wind adds to the cost of wind installations. Southern Company is a summer peaking utility, but wind energy is at a minimum in the Southeast in the summer months. Consequently, wind generation requires redundant power generation resources to meet seasonal peak loads.

These factors taken together lead us to conclude that wind resources in the Southeast, unlike other areas of the country, are limited, costly and not of sufficient quality to support large amounts of utility-scale wind generation.

BIO MASS GENERATION

Commercially available biomass-based options include landfill gas and co-firing biomass in existing power plants. We have surveyed landfill sites in the Southeast and have concluded that, at a maximum, there may be a total of 200 MW of available capacity scattered throughout our region. Landfills lack the necessary power transmission capability to export electricity and must secure environmental permits to use reciprocating engines for power generation. These factors constrain landfills as cost-effective generation resources.

The Southeast does have abundant biomass resources in the form of wood and other agricultural crops. For over 10 years, we have been evaluating these resources by co-firing biomass fuels in our existing coal-fired generating plants. While we have proven that biomass can be successfully co-fired with coal, it is not without technical challenges. Biomass is much less dense than coal, requiring a large volume of fuel to be handled. Figures 9 and 10, below, indicate the impact of co-firing on power

*All figures have been retained in committee files.

plant operations. Large areas of biomass storage and handling are required to accommodate the low mass density materials. We believe co-firing will be limited to no more than 5% of the energy input to a coal-fired power plant as shown in Figure 11.

Moreover, the ash residue left from combusting biomass contains alkali and alkaline earth elements, such as sodium, potassium and calcium. These compounds bind irreversibly with the catalysts being used in Selective Catalytic Reduction (SCR) reactors that have been installed on Southern Company's large, coal-fired generating plants. See Figure 12. These compounds can lead to increased catalyst plugging and cause deactivation of SCR catalysts, thus reducing or eliminating the ability of this technology to reduce NO_x emissions. Thus, current biomass co-firing technology cannot be deployed on the majority of Southern's fleet of generating plants.

NEW TECHNOLOGY APPROACHES

An alternative technical approach to co-firing is the gasification of biomass to form a synthetic fuel gas. Southern Company has extensive experience with coal-gasification having worked with the U.S. Department of Energy for over 10 years to bring Transport Reactor gasification technology to commercialization based on research conducted at the Power Systems Development Facility, managed and operated by Southern Company. This research culminated in 2004 with an announcement to construct the first commercial plant using Transport Reactor technology. We have recently initiated R&D efforts in our company to use this knowledge for the pressurized gasification of biomass. This R&D program is just starting in a partnership with TVA and EPRI and will require several years of technology development to prove its commercial viability. However, we believe, of all the renewable energy technology choices available to us, pressurized biomass gasification has the best chance to be a cost-effective, utility-scale renewable option in the Southeast and we are pursuing it.

IMPLICATION OF RENEWABLE PORTFOLIO STANDARDS

Against this backdrop of the renewable resources available to us, we are concerned about mandates that would require us to utilize fixed amounts of renewable resources. We prefer to seek cost-effective additions to our generation portfolio based on technology maturity, technical performance, and economic viability. As natural gas prices continue to rise, renewables can be an important hedge against fuel cost increases and provide additional stimulus to pursue advanced biomass gasification.

CONCLUSION

Southern Company has a long history of utilization of renewable energy. We continually assess our generation options—including renewable options—to provide low-cost, reliable energy to meet the growing demands for electric power in our region. Not every technology will be well-suited to every region of the country. We will continue to work to facilitate generation technology options—including renewable options—that ensures a reliable, affordable and environmentally sound supply of energy to meet the growing demands for electric power in our region.

Senator ALEXANDER. Thank you, Mr. Bowers.
Mr. Nogee.

STATEMENT OF ALAN NOGEE, DIRECTOR, CLEAN ENERGY PROGRAM, UNION OF CONCERNED SCIENTISTS, CAMBRIDGE, MA

Mr. NOGEE. Thank you very much, Senator Alexander, Senator Salazar. I appreciate this opportunity. My name is Alan Nogee, the energy program director for the Union of Concerned Scientists.

Since you have my written comments, I'll use my limited time here to respond to some of the arguments against a renewable electricity portfolio standard we've heard today, that it's expensive, that it's unfair to some regions, and that it's an unnecessary mandate.

As Dr. Wiser testified earlier, a wide range of studies has found that increasing renewable energy will reduce the demand for natural gas and the price of natural gas. Those studies have also

found that a renewable portfolio standard will save money for consumers.

Even when gas prices were low, EIA found that a 10 percent renewable standard would break even for electricity customers and create savings for natural gas customers. With today's gas price forecasts, EIA's model, even with very pessimistic assumptions about renewable energy costs, finds that a 20 percent renewable standard would reduce both electricity and gas prices when we run that model out of the box, saving consumers \$25 billion. Using our assumptions about renewable energy costs, we find that a 20 percent renewable standard would save consumers \$49 billion. In addition, a 20-percent standard would give a major boost to the economy. It would produce 157,000 net additional jobs, \$16 billion in income to farmers, and \$5 billion in new property tax revenues for local communities.

Now, of course, renewable resources do vary in quantity and quality by region. Some regions would gain more of those benefits than others. Some have, therefore, criticized the RPS as creating winners and losers among regions. But this criticism ignores the fact that today most States have to import fossil and nuclear fuels from other States, and nationally we're increasingly dependent on importing natural gas from unstable and unfriendly countries. Under a national RPS, every region of the country will be able to increase its use of clean, local energy resources.

Additionally, the manufacturing jobs for those renewables are spread throughout the country. A recent study by the Renewable Energy Policy Project found that some of the leading States to gain from renewables development would be Rust Belt States like Ohio, Michigan, Illinois, Indiana, Pennsylvania, and Wisconsin, and Southern States, like South Carolina, North Carolina, Tennessee, Alabama, Georgia, Virginia, and Florida.

No one prefers mandates if they're not necessary, but the renewables standards in 18 States plus the District of Columbia proved that such standards can be effective, affordable, and popular. Even with those standards, however, EIA projects that non-hydro renewables will increase from only 2 percent today to about 3 percent by 2025, a far cry from the 10 or 20 percent that EIA's studies, as well as ours, has found would be cost effective. That means, simply, without a national standard, the American people will pay higher electricity bills, higher gas bills, have fewer jobs, poorer communities, dirtier air, and be more dependent on overseas imports of natural gas.

Moreover, utilities and their customers will bear the risks of much higher costs of reducing carbon emissions down the road if we forego the 59-percent reduction in projected power plant carbon emissions that a 20-percent renewables standard would provide while saving consumers money.

Many of the RPS's benefits aren't captured in utility cost-benefit decisions. Renewables save money over a 20- to 30-year operating life of a renewable plant, but utilities are increasing—in an increasingly competitive environment look for much shorter paybacks. The benefits to natural gas customers are off electric utility balance sheets, as are the benefits to rural communities and the manufacturing jobs and the national energy security. Utilities sim-

ply will not invest, they are not investing, and they will not invest in the level of renewables that are cost effective for our economy, as a whole.

Finally, we note that a renewable fuels mandate has been supported by the House, by the Senate and the White House, even though EIA shows that a renewable fuel standard would cost consumers money, while a renewable electricity standard would save consumers money. And even though, if regional equity is a concern, these maps demonstrate the map of existing and proposed renewable electricity projects widely dispersed around the entire country, as opposed to renewable fuels facilities, which are highly concentrated in the Midwest and Upper Midwest, as on this map over here.

Now, that doesn't mean that there's necessarily a problem with a renewables fuel standard. But if you like a renewables fuel standard for its fuel diversity, energy security, and potential environmental benefits, as we would without an MTBE liability waiver, you should love our renewable electricity standard.

Renewable energy is still—

Senator ALEXANDER. The 5 minutes is up, Mr. Nogee, but go ahead, please finish your thoughts, and we'll—so we can get on to our questions.

Mr. NOGEE. Thank you. It's my last two sentences, Senator.

Renewable energy is still trying to break into a market skewed by tens of billions of dollars of Federal subsidies for fossil and nuclear sources over many decades. We need an effective national policy to promote renewable energy, rather than leaving the critical national price-stability, energy-security, job-creating, clean-energy benefits of renewable energy to the states and to individual volunteers.

Thank you.

[The prepared statement of Mr. Nogee follows:]

PREPARED STATEMENT OF ALAN NOGEE, DIRECTOR, CLEAN ENERGY PROGRAM,
UNION OF CONCERNED SCIENTISTS, CAMBRIDGE, MA

I. INTRODUCTION

The Union of Concerned Scientists (UCS) is a nonprofit organization of more than 60,000 citizens and scientists working for practical environmental solutions. For more than two decades, UCS has combined rigorous analysis with committed advocacy to reduce the environmental impacts and risks of energy production and use. Our Clean Energy Program focuses on encouraging the development of clean and renewable energy resources, such as solar, wind, geothermal, and bioenergy, and on improving energy efficiency.

We favor the adoption of policies to increase the use of renewable energy resources in our nation's electricity generation mix. Such policies are needed to meet our future electricity needs, diversify our electricity supply, reduce the vulnerability of our energy system, stabilize electricity prices, and protect the environment. Specifically, we endorse a renewable electricity standard, also known as a renewable portfolio standard (RPS)—a market-based mechanism that requires utilities to gradually increase the portion of electricity produced from renewable resources.

The United States is blessed by an abundance of renewable energy resources from the sun, wind, and earth. The *technical* potential of good wind areas, covering only 6 percent of the lower 48 state land area, could theoretically supply more than one and a third times the total current national demand for electricity. We have large untapped geothermal and biomass (energy crops and plant waste) resources. Of course, there are limits to how much of this potential can be used economically, because of competing land uses, competing costs from other energy sources, and limits to the transmission system. The important question is how much it would cost to

supply a specific percentage of our electricity from renewable energy sources. As this testimony will show, *analyses by both UCS and Energy Information Administration (EIA) demonstrate we could generate at least 20 percent of our electricity from renewable energy sources by 2020*, in addition to our existing hydro resources, while reducing prices for both electricity and gas customers.

In this testimony, I will review the evidence that shows that increasing renewable energy will save money for consumers, improve energy and national security, create jobs and income for American farmers and workers, improve the environment and reduce financial risks for utilities. I will also address why an RPS, along with other policies, is necessary to achieve these benefits, and why continuing to rely only on voluntary and state efforts will impose higher costs on families and businesses, weaken energy security, and harm the environment for all Americans.

II. RENEWABLE ENERGY CAN REDUCE NATURAL GAS AND ELECTRICITY PRICES

Energy is critical to our economy. Stephen Brown, director of energy economics at the Dallas Federal Reserve Bank, notes that "nine of the 10 last recessions have been preceded by sharply higher energy prices."

Today's high natural gas prices, caused in part by a boom in natural gas power plant construction, are causing economic harm. In the February 11, 2005 release on the Short-Term Energy Outlook, the Energy Information Administration (EIA) found that the average Henry Hub natural gas spot price was \$6.32 per Mcf in January. EIA estimates spot prices at Henry Hub will average \$5.45 per Mcf in 2005 and \$5.77 in 2006. These natural gas prices today are more than double their 1990's levels.

Because natural gas accounts for about 90 percent of the costs of fertilizer, escalating prices have put farmers under a severe economic hardship. Some manufacturing facilities and industrial users that rely heavily on natural gas have already had to reduce operation or move their factories overseas. On February 17, 2004, *The Wall Street Journal* reported that the U.S. petrochemical industry, which is heavily dependent on natural gas for a primary feedstock as well as for fuel, has lost approximately 78,000 jobs to foreign plants where the natural gas is much cheaper.

Natural gas prices show no signs of returning to historic levels. EIA has raised its forecast of long-term natural gas prices for each of the last seven years. Moreover, a recent Lawrence Berkeley Lab study has found that EIA's gas forecasts have been and continue to be at least 50 cents/mmBtu lower than market forecasts, based on gas futures contracts.

Renewable energy can help reduce the demand for natural gas and lower gas prices. On January 5, 2005, the Lawrence Berkeley National Laboratory (LBL) released a review of 13 studies and 20 specific analyses using different computer models and different assumptions. The analyses all confirmed that renewable energy (and energy efficiency) can reduce gas demand and put downward pressure on natural gas prices and bills by displacing gas-fired electricity generation. They found that the higher the level of renewable energy penetration, the more gas is saved, and the more gas prices are reduced. The LBL study also shows how these results are broadly consistent with economic theory, with results from other energy models, and with limited empirical evidence. Many of the analyses LBL reviewed were conducted by EIA and by UCS.

Even in 2002, when gas prices and price projections were considerably lower than they are today, an EIA analysis conducted at the request of Senator Frank Murkowski (R-AK) showed that a 10 percent renewable electricity standard like the one that subsequently passed the Senate would have a negligible impact on electricity prices. EIA found only a one mill (one tenth of one cent) per kWh increase in 2020 with a 10 percent RPS, and no impact in most years. When gas savings were considered, total electricity and gas bills were found to be as much as \$13.2 billion lower with the 10 percent RPS (2000 dollars, 8 percent discount rate).

In April 2004, with the assistance of the Tellus Institute, we ran NEMS with no changes to the model, using all EIA assumptions. Because of the higher EIA gas price projections, the results showed that even an RPS of 20 percent by 2020 would reduce electricity and gas prices. Cumulative savings to electricity customers under a 20 percent RPS totaled \$11 billion (net present value) by 2025, with cumulative savings to gas consumers of an additional \$14 billion, for a \$25 billion total savings (Figure 2).*

EIA uses very pessimistic projections of renewable energy technology costs. The model also imposes artificial limits on renewable energy penetrations, and arbitrarily high costs at increasing levels of renewable penetration. We have therefore

*Figures 1-3, and all additional attachments, have been retained in committee files.

tested the result of using cost projections closer to (but still somewhat more conservative than) those used by the national energy labs, and penetration limits and cost estimates based on utility studies and experience.

In our analysis, the consumer savings nearly doubled to \$49 billion, with \$35 billion in electricity savings, and \$14 billion in gas savings (Figure 3).

The most important conclusion, however, is that whether you believe that EIA's pessimistic projections of renewable energy costs are more likely, or the national lab projections, the analyses show that a 20 percent RPS would save both electricity and natural gas consumers money in either case.

A 10 percent renewable standard would save money too, but not as much. In our analysis we found that with a 10 percent renewable standard by 2020, electricity and gas consumers would save almost \$20 billion, compared to \$49 billion under the 20 percent standard. Residential consumers could save an estimated \$5.8 billion on their energy bills by the year 2025. Commercial and industrial customers would be the biggest winners saving a total of \$13.8 billion between them.

III. RENEWABLE ENERGY CAN IMPROVE ENERGY AND NATIONAL SECURITY

In response to rising gas prices, and the declining productivity of North American gas wells, imports of LNG are projected to increase by sixteen fold over the next 20 years. This trend—assuming that the LNG infrastructure can be expanded sufficiently—threatens to push America down the same troubled road of rising dependence on imported gas that we have followed for oil. By reducing the demand for natural gas, renewable energy can reduce the pressure for increasing imports. Energy from the wind, sun, and heat of the earth are America's most abundant resources. They can never be depleted.

Renewable energy can increase energy and national security in other ways as well. Lacking long fuel supply chains, renewable energy facilities are not vulnerable to supply disruptions, and the price shocks they can cause. Because they do not use volatile fuel or produce dangerous wastes, renewable energy facilities (except large hydropower dams) do not present inviting targets for sabotage or attack.

IV. RENEWABLE ENERGY CAN CREATE JOBS AND INCOMES FOR AMERICAN FARMERS AND WORKERS

Renewable energy can help improve our national economy. Investments in indigenous renewable energy sources keep money circulating and creating jobs in regional economies. Renewable energy can greatly benefit struggling rural economies, by providing new income for farmers and rural communities. It can also benefit manufacturing states, even those with less abundant renewable resources, by providing them the opportunity manufacture and assemble components for renewable energy facilities. And renewable energy can create enormous export opportunities, given the growing commitment of the rest of the world to expand use of renewable energy.

With the assistance of consultant Marshall Goldberg, we ran the results of our NEMS runs through the IMPLAN input-output model of the U.S. economy, and found that a 20 percent RPS by 2020 would produce:

- More than 355,000 new jobs in manufacturing, construction, operation, maintenance, and other industries, nearly twice as many jobs as producing the same amount of electricity from fossil fuels—a net increase of nearly 157,500 jobs by 2020;
- An additional \$8.2 billion in income and \$10.2 billion in gross domestic product in the United States' economy;
- \$72.6 billion in new capital investment;
- \$15 billion in payments to farmers and rural areas for producing biomass energy;
- \$5 billion in new property tax revenues for local communities; and
- \$1.2 billion in wind power land lease payments to farmers, ranchers, and rural landowners.

Since renewable resources vary in quantity and quality among states, some states will obviously reap more of these economic development benefits than others. Some have therefore criticized a federal RPS for creating “winners and losers” among states. This criticism ignores the fact that most states are currently energy losers, importing fossil and nuclear fuels from other states and increasingly from other countries.

Renewable energy resources are much more broadly dispersed than fossil fuel resources. A national renewable standard would therefore greatly broaden the number of states that are energy winners. Virtually every state should be able to increase

its use of its own resources for generating electricity, build its local economy, and be less dependent on importing energy from other states and countries.

Additionally, recent analysis by the Renewable Energy Policy Project (REPP) found that the economic benefits are not localized to the states that have the most renewable energy resources. REPP examined the capability of the manufacturing industries in each state to supply components for wind and solar facilities. They found that the top 20 states for wind component manufacturing would be California, Ohio, Texas, Michigan, Illinois, Indiana, Pennsylvania, Wisconsin, New York, South Carolina, North Carolina, Tennessee, Alabama, Georgia, Virginia, Florida, Missouri, Massachusetts, Minnesota, and New Jersey. The top 20 states for solar manufacturing would be California, Texas, Arizona, New York, Pennsylvania, Massachusetts, Illinois, Ohio, Oregon, Florida, North Carolina, New Jersey, Colorado, Washington, Virginia, Indiana, Michigan, Minnesota, New Mexico, and Missouri.

Interestingly, some have criticized a national RPS for electricity on “regional equity” grounds while supporting a national Renewable Fuels Standard (RFS). As the maps in Attachment I show, renewable energy resources are much more broadly distributed than ethanol production resources. In addition, EIA studies have found that the RFS would cost consumers money, while the RPS would save consumers money. This is not to argue that the energy security and potential environmental benefits of renewable fuels are not worth those costs. But anyone who likes a renewable fuels standard—as UCS would without an MTBE liability waiver—should love a renewable electricity standard, with its overall consumer savings and broader distribution of benefits, as well as energy security and environmental benefits.

V. RENEWABLE ENERGY CAN IMPROVE OUR ENVIRONMENT AND REDUCE FINANCIAL RISKS TO UTILITIES

Electricity use has a significant impact on the environment. Electricity accounts for less than 3 percent of U.S. economic activity. Yet, it accounts for more than 26 percent of smog-producing nitrogen oxide emissions, one-third of toxic mercury emissions, some 40 percent of climate-changing carbon dioxide emissions, and 64 percent of acid rain-causing sulfur-dioxide emissions. Renewable energy can reduce these emissions, thereby reducing the cost of hitting any emission caps.

Our analysis found that a 20 percent renewable electricity standard could reduce the projected growth in power plant carbon dioxide emissions by 59 percent by 2025. Because the 20 percent renewable standard would save money for electricity and gas consumers, these are free (or negative cost) carbon reductions. They represent free insurance against the risk that power plants—the largest source of carbon emissions in the U.S. economy—may have to reduce those emissions someday.

Even most utility executives believe that they will have to implement carbon reductions eventually. Yet in response to the increase in natural gas prices, more than 100 new coal-fired power plants have been proposed. These plants will expose their owners, power purchasers, and customers to the risk of future price increases that could be avoided by investing in renewable energy instead. Indeed, under an economy-wide cap-and-trade approach, the carbon reductions from increasing renewable energy will save money for every sector of the economy.

Whether you think that the risk of climate change is great or small, increasing renewable energy can reduce the risk of responding to it. And renewable energy reduces emissions of sulfur dioxide, nitrogen oxides, particulates, and mercury, reducing the cost of complying with emission reduction requirements for these pollutants as well.

VI. WHY A RENEWABLE PORTFOLIO STANDARD?

If increasing renewable energy would save consumers money, why aren’t utilities switching to renewables? In fact, a few are beginning to invest in wind, energy as a purely economic proposition. Others are financing renewable energy development by allowing customers to volunteer to pay a little more for renewable energy. But the reality is that about three-quarters of the renewable energy developed in recent years, and projected to be developed in the next decade, is the result of state renewable electricity standards.

Renewable energy has made great strides in reducing costs, thanks to research and development and growth in domestic and global capacity. The cost for wind and solar electricity has come down by 80-90 percent over the past two decades. However, like all emerging technologies, renewable resources face commercialization barriers. They must compete at a disadvantage against the entrenched industries. They lack infrastructure, and their costs are high because of a lack of economies of scale.

Renewable energy technologies face distortions in tax and spending policy. Studies have established that federal and state tax and spending policies tend to favor fos-

oil-fuel technologies over renewable energy. A 2003 study by the Renewable Energy Policy Project showed that between 1943 and 1999, the nuclear industry received over \$145 billion in federal subsidies vs. \$4.4 billion for solar energy and \$1.3 billion for wind energy. Another study by the non-partisan Congressional Joint Committee on Taxation projected that the oil and gas industries would receive an estimated \$11 billion in tax incentives for exploration and production activities between 1999 and 2003. In addition to these subsidies, conventional generating technologies enjoy a lower tax burden. Fuel expenditures can be deducted from taxable income, but few renewable technologies benefit from this deduction, since most do not use market-supplied fuels. Income and property taxes are higher for renewable energy, which require large capital investments but have low fuel and operating expenses.

Many of the benefits of renewable resources, such as reduced pollution and greater energy diversity, are not reflected in market prices, thus eliminating much of the incentive for consumers to switch to these technologies. Other important market barriers to renewable resources include: lack of information by customers, institutional barriers, the small size and high transaction costs of many renewable technologies, high financing costs, split incentives among those who make energy decisions and those who bear the costs, and high transmission costs.

Some have called for future support of renewable energy through “green marketing,” selling portfolios with a higher renewable energy content (and lower emissions) to customers who are willing to pay more for them. We strongly support green marketing as a means to increase the use of renewable energy and reduce the environmental impacts of energy use. Surveys show that many customers are willing to pay more for renewable energy, and pilot programs have shown promising, but not overwhelming results.

Green marketing is not a substitute for sound public policy, however. There are many barriers to customers switching to green power, not the least of which is inertia. More than fifteen years after deregulation of long-distance telephone service, half of telephone customers still had not switched suppliers, even though they could get much lower prices by doing so. A 2003 study by the National Renewable Energy Laboratory projects that in an optimistic scenario, green marketing could increase the percentage of renewable energy in our electricity mix from about 2 percent today to only about 3 percent in ten years.

With green electricity, the benefits of any individual customer’s choice accrue to everyone, not the individual customer. Green customers get the same undifferentiated electrons and breathe the same air as their neighbors choosing to buy power from cheap, dirty coal plants, creating a strong incentive for people to be “free riders” rather than pay higher costs for renewable resources. People recognize this public benefits aspect of green power. While they consistently say they are willing to pay more for electricity that is cleaner and includes more renewable energy, they overwhelmingly prefer everyone paying for these benefits to relying on volunteers. A deliberative poll by Texas utilities found that 79 percent of participants favored everyone paying a small amount to support renewable energy, versus 17 percent favoring relying only on green marketing.

Fortunately, 18 states plus the District of Columbia have enacted renewable portfolio standards. The RPS is a market-based mechanism that requires utilities to gradually increase the portion of electricity produced from renewable resources such as wind, biomass, geothermal, and solar energy. It is akin to building codes, or efficiency standards for buildings, appliances, or vehicles, and is designed to integrate renewable resources into the marketplace in the most cost-effective fashion.

By using tradable “renewable energy credits” to achieve compliance at the lowest cost, the RPS would function much like the Clean Air Act credit-trading system, which permits lower-cost, market-based compliance with air pollution regulations. Electricity suppliers can generate renewable electricity themselves, purchase renewable electricity and credits from generators, or buy credits in a secondary trading market. This market-based approach creates competition among renewable generators, providing the greatest amount of clean power for the lowest price, and creates an ongoing incentive to drive down costs.

The states have proven that renewable electricity standards are popular and can be effective. We project that state RPS laws and regulations will provide support for more than 25,550 megawatts (MW) of new renewable power by 2017—an increase of 192 percent over total 1997 U.S. levels (excluding hydro). This represents enough clean power to meet the electricity needs of 17.2 million typical homes. We estimate that by 2017 these state RPS programs will also reduce carbon dioxide emissions—the heat-trapping gas primarily responsible for global warming—by 65.2 million metric tons annually. This is equivalent to taking 9.7 million cars off the road or planting more than 15.6 million acres of trees—an area approximately the size of West Virginia.

As encouraging as these state developments have been, they are not enough to capture renewable energy's potential benefits to the national economy. Under a 10 percent RPS, we would have approximately 100,000 MW of non-hydro renewables. Under a 20 percent RPS, we would have 180,000 MW of non-hydro renewables—and save consumers money.

Many people forget that we have given voluntary measures and incentives more than a fair try. The Energy Policy Act of 1992 called for increasing our renewable energy supplies by 75 percent, and enacted the production tax credit. Unfortunately, these measures have not been successful at stimulating more than very limited renewable energy development outside of states that have implemented renewable portfolio standards. It is time for a national minimum standard, on which states and volunteer efforts can continue to build.

Energy production creates national economic and environmental problems that need national solutions. A national renewables standard would establish uniform rules for the most efficient trading of renewable energy credits. This uniformity would reduce renewable energy technology costs by creating economies of scale and a national market for the most cost-effective resources.

The RPS enjoys widespread bipartisan political support. In 2002, 143 members of the House, including 21 Republicans called for including a Renewable Portfolio Standard in an energy bill. In a September 2003 letter to the conferees, a bipartisan group of 53 Senators supported including a strong RPS in the energy bill conference report. The U.S. Senate has twice passed an RPS and the majority of Senators on the energy bill conference supported the Bingaman RPS amendment.

The RPS is the surest mechanism for securing the public benefits of renewable energy sources and for reducing their cost to enable them to become more competitive. It is a market mechanism, setting a uniform standard and allowing companies to determine the best way to meet it. The market picks the winning and losing technologies and projects, not administrators. The RPS will reduce renewable energy costs by:

- Providing a revenue stream that will enable manufacturers and developers to obtain project financing at a reasonable cost and make investments in expanding capacity to meet an expanding renewable energy market.
- Allowing economies of scale in manufacturing, installation, operation and maintenance of renewable energy facilities.
- Promoting vigorous competition among renewable energy developers and technologies to meet the standard at the lowest cost.
- Inducing development of renewables in the regions of the country where they are the most cost-effective, while avoiding expensive long-distance transmission, by allowing national renewable energy credit trading.
- Reducing transaction costs, by enabling suppliers to buy credits and avoid having to negotiate many small contracts with individual renewable energy projects.

Some people have asked why hydropower is not eligible to earn renewable energy credits in most RPS proposals. The difference with hydro is that it is a mature resource and technology. In most cases, it is already highly competitive. It will not benefit appreciably from the cost-reduction mechanisms outlined above, and an RPS that included hydro would likely produce small, if any, increases in hydro generation. Additionally, new dams are unlikely to be built and are environmentally questionable. Nevertheless, we have supported RPS's that include incremental hydro generation from existing dams. Now that a Low Impact Hydro Institute (LIHI) certification process with broad stakeholder support is operating, we recommend that the definition of incremental hydro refer to incremental generation at LIHI-certified facilities.

Some people have also expressed concerns about the variable output of renewable sources like solar and wind, and believe that an RPS would affect the reliability of our energy system. However, the electric system is designed to handle unexpected swings in energy supply and demand, such as significant changes in consumer demand or even the failure of a large power plant or a transmission line. Solar energy is also generally most plentiful when it is most needed—when air-conditioners are causing high electricity demand. There are several areas in Europe, including parts of Spain, Germany, and Denmark, where wind power already supplies over 30 percent of the electricity with no adverse effects on the reliability of the system. In addition, several important renewable energy sources, such as geothermal, biomass, and landfill gas systems can operate around the clock. Studies by the EIA and the Union of Concerned Scientists show these non-intermittent, dispatchable renewable energy plants would generate about half of the nation's non-hydro renewable energy under a 10 percent RPS in 2020. Renewable energy can increase the reliability of

the overall system, by diversifying our resource base and using supplies that are not vulnerable to periodic shortages or other supply interruptions.

A summary of studies presented at the European Wind Energy Conference in June 2003 indicate that the impacts and costs for large scale wind generation on the power grid are relatively low at penetration rates that are expected over the next several years. At the relatively low penetration levels we see today, the cost is only 0.2 to 0.3 cents per kWh. A 2003 study by PacifiCorp estimated that the additional costs of integrating 2,000 MW of renewables—nearly 20 percent of its system capacity—were between 0.5 and 0.6 cents per kWh. In fact, the PacifiCorp 2003 least cost plan included 1,400 MW of wind capacity.

VII. ADDITIONAL POLICIES ARE NEEDED

A number of complementary policies should be enacted to reduce market barriers to renewable energy development:

- Extending production tax credits of 1.8 cents per kWh and expanding them to cover all clean, renewable resources (excluding hydropower);
- Adopting national net metering standards, allowing consumers who generate their own electricity with renewable energy systems to feed surplus electricity back to the grid and spin their meters backward, thus receiving retail prices for their surplus power production; and
- Increasing spending on renewable energy research and development.

The deployment of all these policy solutions will be required to truly level the playing field for renewable energy. It is especially important that the Production Tax Credit be extended for a period of at least five to ten years to provide predictability and price stability in the renewables industry and avoid the costly boom-bust cycles created by the recent history of short-term extensions.

The PTC should be extended for all renewable energy technologies. The Administration's recent budget assumed that the geothermal energy credit included in the last extension would now be dropped. Geothermal can play an important near-term role in reducing the demand for gas, especially in the Western states that have experienced significant price volatility in recent years.

Net metering is essential to ensure that customers who invest their own money in renewable energy in their buildings get fairly compensated for excess electricity they produce. Net metering is not sufficient to promote renewable energy development, but it is essential to promote the use of clean, distributed resources like solar energy.

Additionally, we urge Congress to pass a suite of policies to improve energy efficiency, including both demand-side efficiency and supply-side efficiency, such as providing incentives for combined heat and power plants. The LBL study and many others have found that energy efficiency is the least expensive way to reduce natural gas demand and natural gas prices.

VIII. CONCLUSION

Survey after survey has shown that Americans want cleaner and renewable energy sources, and that they are willing to pay more for them. A survey conducted in 2002 by Mellman Associates found that when presented with arguments for and against a 20 percent RPS requirement, 70 percent of voters support an RPS, while only 21 percent oppose it.

The combination of EIA and UCS studies demonstrate that with appropriate policies, renewable energy technologies can provide Americans with the clean and reliable electricity they desire, while also saving them money, contributing to our nation's energy security, and achieving significant reductions in harmful emissions.

The net metering and renewable energy production incentive provisions included in the current draft bill before the committee are laudable and deserving of support. But by themselves, these provisions will not get the job done. A strong, market-friendly renewable energy standard is required to realize the full potential of America's renewable energy resources.

For all of these reasons, we respectfully urge that as the Committee moves forward with its development of national energy legislation, you support inclusion of a renewable portfolio standard.

Thank you.

Senator ALEXANDER. Thank you, Mr. Nogee.
Mr. O'Shaughnessy.

STATEMENT OF BRIAN O'SHAUGHNESSY, PRESIDENT AND CHIEF EXECUTIVE OFFICER, REVERE COPPER PRODUCTS, INC., ROME, NY, ON BEHALF OF THE NATIONAL ASSOCIATION OF MANUFACTURERS

Mr. O'SHAUGHNESSY. Good afternoon, Senator Alexander and Senator Salazar.

I'm Brian O'Shaughnessy, president of Revere Copper Products. My company was founded by Paul Revere in 1801, and may be the oldest manufacturing company in the United States. Our mission is to be the best in the world at what we do, and have fun doing it. This means using, to the fullest extent, the talents of all Revere people, working as a team in a safe, environmentally sound, and ethical manner to achieve absolute customer satisfaction through superior quality and reliability. I'd point out, this statement is 17 years old, "environmentally sound, ethical, and having fun."

But if the RPS provisions in the Senate Energy bills of the past two Congresses were enacted and fully implemented several years ago, the extra costs would have caused Revere to violate its banking covenants and driven us out of business, or led to a reduction of capital expenditures over the years that would have made continuing in business problematic.

My background stretches from manufacturing to energy generation, transmission, distribution, regulation, and consumption, to natural resources and reserves, to environmental research based on sound science. So I'd like to share some observations on the subject of renewable power with you.

Since the potential for increasing other sources of renewable power is modest, let's assume that wind energy would provide the bulk of a Federal renewable energy requirement. Germany, Denmark, and Great Britain have all recognized the practical and cost limitations of large wind power programs. A recent study by the Royal Academy of Engineering in England determined that wind power in Great Britain would be approximately three times the cost per kilowatt hour of pulverized coal or nuclear power plants. The estimate considered the cost of adequate standby generation to provide power when the wind did not blow, but their estimate did not consider the cost of additional transmission facilities to connect remote wind farms to consumers. The PUC of Texas estimates that cost would be one billion to meet half of your requirements, or 20 billion on a national level.

Since wind, at best, averages to generate electricity only 35 per cent of the time in the United States, roughly three times as many windmills would have to be built in order to meet the RPS sales requirement, yet transmission lines have to be built to accommodate the maximum loads.

Both in Texas and Great Britain, combined cycle gas generation is the preferred peaking power to back up wind power. So, instead of building the least expensive, but more difficult to permit coal and nuclear generation capacity, a Federal RPS requirement could have the unintended consequence of actually increasing gas use in electricity generation, rather than reducing it, as some proponents claim.

A 1.5-cent penalty fee would simply be paid by generators and passed on to consumers and manufacturing companies given: one,

the cost of building three times as many windmills in order to meet the requirement that 10 percent of sales be from renewable energy; two, building transmission to remote areas; three, dealing with matching dispatch and load harmonization; four, building the required backup generation; and, five, acknowledging the lack of access to wind in many regions of the country.

Accordingly, many industry experts expect that the majority of electricity generators would simply pay the fee and attempt to pass the tax through to the consumer and, of course, manufacturing companies.

Some argue that wind power is necessary to save natural gas resources for other uses or for future generations. We are seeing an unprecedented buildup of natural gas supply from foreign resources that are scarcely tapped and will be available for generations to come. Is it wise to have a national policy that saves this low-cost gas for Chinese manufacturing companies while American manufacturing companies and their workers and taxpayers are forced to pay the higher cost of renewable wind power?

A number of States are pursuing mandated RPS, including, unfortunately, my home State. Frankly, there are enough experiments in the United States going on with wind power and other RPS sources that our Nation will gain the benefits or reap the failure of these experiments without putting our whole country at risk.

One pretty good clue is that if a government program is mandated, subsidized, and surcharged, it's probably not good economic policy. In my opinion, no such wasteful economic policy is sustainable, and will only have a negative impact on the environment in the long run.

Manufacturing in the United States is under assault like never before. I believe that providers and jobs in the United States are taxed, sued, and screwed to death by what are largely unintended consequences of government action. All too often, the focus in the U.S.A. is protection of the factory worker, while the endangered species is a factory job with a good wage in the safest, cleanest environment in the world.

Please, don't hit us with another mandate. Let the midnight ride continue.

Thank you for this opportunity, and I look forward to answering any questions you may have.

[The prepared statement of O'Shaughnessy follows:]

PREPARED STATEMENT OF BRIAN O'SHAUGHNESSY, PRESIDENT AND CHIEF EXECUTIVE OFFICER, REVERE COPPER PRODUCTS, INC., ROME, NY, ON BEHALF OF THE NATIONAL ASSOCIATION OF MANUFACTURERS

Good morning, Mr. Chairman and members of the committee. I am Brian O'Shaughnessy, President and Chief Executive Officer of Revere Copper Products, Inc. Today, I am pleased to have the opportunity to testify on behalf of the National Association of Manufacturers (NAM) in opposition to proposals to mandate a federal Renewable Portfolio Standard (RPS) for electricity generators.

As you undoubtedly are aware, the NAM is the nation's largest industrial trade association representing small and large manufacturers in every industrial sector and in all 50 states. The NAM's mission is to enhance the competitiveness of manufacturers and improve American living standards by shaping a legislative and regulatory environment conducive to U.S. economic growth. In light of our dedication to that mission, the NAM commends the Chairman and ranking Democrat for your efforts to produce comprehensive energy legislation again this Congress. Since the President's energy proposals in 2001, the NAM has been very active in support of

comprehensive energy policies that will increase the supply of affordable and reliable energy from all sources, to improve the nation's energy infrastructure, and to support energy efficiency and innovative energy technologies. At the same time, the NAM has just as actively opposed federal imposition of Carter-era types of command and control energy mandates, such as arbitrarily high CAFE standards, fossil energy rationing through carbon regulation or one-size-fits-all renewable portfolio mandates.

My company was founded by Paul Revere in 1801 and may be the oldest manufacturing company in the U.S.A. Our headquarters and principal manufacturing plant are in Rome, N.Y., plus we have a smaller operation in Massachusetts. Our annual sales are over \$200 million and we employ about 500 people.

Everyone who works at Revere owns a piece of Revere and no one outside of Revere owns any of Revere. We do not pay dividends and reinvest every cent of cash flow above that needed to meet bank covenants to sustain the business.

Our mission is *"to be the best in the world at what we do and have fun doing it. This means using to the fullest extent the talents of all Revere people working as a team in a safe, environmentally sound and ethical manner to achieve absolute customer satisfaction through superior quality and reliability."* (This statement is 17 years old!)

Revere delivers its goods anywhere, anytime as the midnight ride continues. We produce copper and copper alloy sheet, strip, coil and industrial plate as semi-finished products, which we ship to other manufacturing companies mostly in the U.S.A. This means the health of manufacturing in the U.S.A. is of paramount importance to our future. Revere competes with other similar facilities in the America and throughout the world. In recent years, our biggest competition is the competition our customers face from imported manufactured goods, largely from China, that are sold by large retailers.

You can imagine in such a fiercely competitive world that cost control is critical, along with quality and reliability concerns. It is for that reason that the NAM and my company have steadfastly opposed mandatory renewable portfolio standards legislation.

Indeed, if the RPS provisions in the Senate energy bills of the past two Congresses were enacted and fully implemented several years ago, the extra costs would have caused Revere to violate its banking covenants and driven us out of business, or lead to a reduction of capital expenditures over the years that would have made continuing in business problematic.

You might think mandating such RPS provisions in the future would not be harmful to Revere since New York State has a RPS program and Revere would avoid most of the penalty. But Revere is part of a supply chain of other U.S. based manufacturing companies. Any burden placed on one member of that supply chain is a burden on all other members in that it makes the supply chain for that product less competitive with foreign sourced product. According to a recent study by the Manufacturing Institute and the Manufacturers Alliance, U.S. based manufacturing is shrinking rapidly because the cost of manufacturing in the U.S.A. is 22 percent higher than the costs of manufacturing within the borders of our nine largest trading partners. This is not due to wages but to the burden of social costs imposed on manufacturing in the U.S.A. This is a result of the cumulative impact of largely unintended consequences of federal, state and legal actions over the years that are driving costs to manufacture in the U.S.A. to noncompetitive levels. Electric power costs are a key component of most manufacturing and must be competitive with foreign power.

Revere is the largest consumer of electricity in the Mohawk Valley of New York State, with peak demand of 15 MW and annual gas consumption of 575,000 decatherms. Sometimes we switch to oil which drops our gas demand by 250,000 decatherms. Fortunately, New York State has recognized the importance of electricity costs to Revere and provides Revere (through the New York Power Authority) with Economic Development Power at competitive rates allowing us to stay in business.

In New York State, I serve on the Board of Directors of three industrial energy users' groups and chair two of them. One intervenes before the State Public Service Commission in opposition to filings by utilities and other groups. In addition, I serve on the Board of Directors of a public utility that provides transmission and distribution of electricity and gas in Massachusetts and New Hampshire. Of course, this entity applies before the public service commissions of those states to support utility initiatives.

Eight years ago, I championed the formation and then chaired, for seven years, the world-wide, world class copper industry's Environmental Program. This program employs a staff of seven scientists with an annual budget of \$6 million to fund inde-

pendent, peer reviewed research on environmental issues at leading academic and scientific institutions throughout the world. The first 20 years of my career were spent in mining where I gained a strong understanding of natural resources and reserves.

The point is my background stretches from manufacturing to energy generation, transmission, distribution, regulation and consumption to natural resources and reserves to environmental research based on sound science. So I'd like to share some observations on the subject of renewable power with you.

My company and the NAM are strongly opposed to a federally mandated RPS because it would increase the cost of electricity to consumers including the manufacturing sector and do little to improve the environment. It is unclear whether advances in renewable technologies will increase their economics enough to outstrip improvements in conventional power technologies. Since the potential for increasing other sources of renewable power is modest, let's assume that wind energy would provide the bulk of a federal renewable energy requirement.

At the outset, it is important to note that the NAM does not oppose wind power or other alternatives to fossil, nuclear and hydro energy sources. In fact, NAM members manufacture some of the best renewable energy equipment in the world. What concerns the NAM and my company is when the federal government in Washington decides it knows that a one-size-fits-all renewable energy portfolio is the best energy mix for electric utilities whether they are located in New York State, California, Montana or Georgia.

With all due respect, Mr. Chairman, a federal mandate for wind power makes little economic or energy policy sense. Germany, Denmark and Great Britain have all recognized the practical and cost limitations of large wind power programs. A recent study by the Royal Academy of Engineering in England determined that wind power in Great Britain would be approximately three times the cost per kilowatt hour of pulverized coal or nuclear power plants. This estimate considered the cost of adequate standby generation to provide power when the wind did not blow, but their estimate did not consider the cost of additional transmission facilities to connect remote wind farms to consumers. Although often omitted by wind power supporters, new transmission requirements are not an inconsequential cost, particularly because most wind farms will be located in very remote areas rather than, say, just off of Nantucket.

In fact, often it is the potential transmission costs for wind and geothermal that completely ruins the economics of a proposed wind program. If we assume that, somehow, half of a 10 percent federal RPS were to be met by new wind power by 2020, that would be about 20,250 MW of new wind generating capacity [using ETA's projected energy consumption from electric utilities in that year of 405,000 MW.] However, past RPS proposals have required that 10 percent of sales be from renewable powered electricity. Since wind at best averages to generate electricity only 35 percent of the time in the U.S., roughly three times as many windmills (or about 60,000 MW of new generating capacity) would have to be built in order to meet the RPS sales requirement. And, since transmission lines have to be built to accommodate the maximum loads, the transmission system would have to be able to handle all the wind from a farm generating at once (which it reasonably would); transmission lines would have to be built to accommodate all 60,000 MW of wind generating capacity.

One state with a RPS is Texas where 2,000 MW of renewable energy are to be built by 2009. The Public Utility Commission of Texas estimates that it will cost over \$1 billion in new transmission to bring a proposed 3,000 MW of new wind power from wind farms in west Texas to consumers in the rest of Texas. This \$1 billion was for just 3,000 MW of new wind power. If that proves to be an average national price, new transmission for all the future wind farms would require \$20 billion in new transmission by 2020, just to meet half of a 10 percent RPS requirement. By contrast, most nuclear, coal and natural gas generation proposals are relatively close to consumers or to current facilities and would require much less additional transmission investment.

Another unfortunate consequence of the intermittent nature of wind power is that on a stifling hot August afternoon when air conditioners are powered up, the wind is not blowing and wind power simply may not be available. The consequences of that are greater than you may expect. First, most states have a requirement for reserve generation capacity to meet not only peak needs but also to meet unusual demands arising from unexpected events, such as supply disruptions or demand swings. For example, that reserve generation requirement may be 18 percent above the prior year's peak demand. But if wind power cannot be counted on when it is needed the most, it should not be counted toward the total generation capacity requirements under state regulations. So, wind power would make almost no contribu-

tion to fulfilling the need for building conventional generation to meet the reserve margin requirements.

That means that when wind power is available, other conventional capacity would have to be shut down for the duration of the wind power generation and started up again as the wind power dies down. Such back-up power must be able to come on and shut down quickly. Due to varying wind patterns around the country, up to 75 percent of the wind generating capacity may need to be backed-up during periods when the wind is not blowing. In some states that have high reserve margins, that back up capacity is already in place. In other states, this reserve may not be in place which would require new generation, most likely in the form of new natural gas units. Both in Texas and Great Britain, combined cycle gas generation is the preferred peaking power to back-up wind power. So, instead of building the least expensive but more difficult to permit, coal and nuclear generating capacity, a federal RPS requirement could have the unintended consequence of actually increasing natural gas use in electricity generation, rather than reducing it as some proponents claim.

It also seems that most of the models for the cost of wind power do not add in the load balancing cost which every other generation source must absorb. Wind power proponents seem to want the consumer to absorb that cost, which would be significantly higher for wind power than for virtually any other kind of power.

The RPS requirement in previous Senate bills contained a 1.5 cent per kilowatt hour fee that could be paid to the government if a utility fails to reach its renewable sales requirement. However, for many generators, this 1.5 cent fee will be for less than the costs of building three times as many windmills in order to meet the requirement that 10 percent of sales be from renewable energy, building transmission to remote areas, dealing with matching dispatch and load harmonization, building the required back-up generation and acknowledging the lack of access to wind or geothermal in many regions of the country. Accordingly, many industry experts expect that the majority of electricity generators would simply pay the fee and attempt to pass that tax through to the consumer. In summary, unless this fee is ratcheted up by a Congress eager to force a one-size-fits-all renewable energy requirement on the nation, the RPS will not really do much to increase renewables or significantly decrease natural gas demand, but it will certainly increase the cost of electricity to manufacturers and other consumers.

Some argue that wind power is necessary to save natural gas resources for other uses or for future generations. The new reality is that natural gas is a global commodity. My company is the world's largest producer of end plates for heat exchangers used to liquefy and allow transportation of natural gas on LNG container ships. We are seeing an unprecedented buildup of natural gas supply from foreign resources that are scarcely tapped and will be available for generations to come. The rest of the world is rushing to build facilities to receive these ships and gas pipelines to transport that gas to the consumer. Is it wise to have a national policy that "saves" this low cost gas for Chinese manufacturing companies while American manufacturing companies and their workers are forced to pay the higher cost of renewable wind power?

As a broad-based, experienced and educated environmentalist with a prejudice based on sound science, I believe that nuclear power is the best source of sustainable power. So does France, which generates 82 percent of its power from such sources. More importantly, so does China, which is rapidly building power generation from diverse sources including natural gas and clean coal as well as nuclear. The U.S.A. should do the same. Again, please understand that I am not against wind power in those cases where its use is aesthetically acceptable and market driven.

A number of states are pursuing mandated RPS, including, unfortunately, my home state. Frankly, there are enough experiments in the U.S.A. going on with wind power and other RPS sources that our nation will gain the benefits or reap the failure of these experiments without putting our whole country at risk. I respectfully request that you consider letting these state efforts precede without federal interference or additional mandates. Maybe I'm wrong and the RPS policy of my state will be shown to be correct, but let's find out as we will over time before enacting a national mandate.

Finally, the NAM is strongly opposed to a federally mandated RPS because it would start the federal government back down the perilous road of dictating fuel choices to the electricity industry. The history of federal interference with energy markets has not been pretty. In the 1970s the federal government asserted control over price and allocation of petroleum products, resulting in a complex regulatory regime that subsidized crude oil imports, penalized domestic production and gave economic favors to preferred groups such as small refiners and rural gas stations.

In the 1978 Natural Gas Policy Act, the federal government responded to natural gas shortages in the Midwest by clamping price controls on unregulated intrastate natural gas and setting up a matrix of some 32 different prices for domestic natural gas. Both the oil regulations and the Natural Gas Policy Act were acts of market interference plagued by temptations to cheat and economic favoritism doled out by Congress to influential groups.

We should not go down this road again. Even the most well-meaning RPS necessarily picks winners and losers among energy sources—what can be a “renewable” and what can’t. And, it necessarily picks winners and losers among the regions of the United States. Only four Western states have any significant geothermal resources, and the entire South has minimal wind power potential. We note that there may be efforts in the Congress to broaden the base of what energy sources may qualify for the RPS, such as adding nuclear, combined heat and power units, and/or clean coal generation. While the NAM supports this emphasis on new and efficient technologies, it is far better policy to provide incentives, research and demonstration assistance, and remove regulatory and political barriers rather than to try to improve on the RPS’s flawed command and control approach. Once established, a federal energy regulatory framework such as an RPS will present a great temptation to the federal government to amplify the program’s politically correct goals over economic realities, increase its burden on the economy and increase the economic advantages of some entities over others.

One pretty good clue is that if a government program is mandated, subsidized and surcharged, it’s probably not good economic policy. In my opinion, no such wasteful economic policy is sustainable and will only have a negative impact on the environment in the long run.

Manufacturing in the United States is under assault like never before. I believe that providers of jobs in the U.S.A. are taxed, sued and screwed to death by what are largely unintended consequences of government action while foreign governments revere (pun intended), subsidize and support anyone who provides a good job. All too often, governmental policymakers and politicians in America support trendy environmental voyages instead of sound science and basic economics that lead to truly sustainable development. All too often, the focus in the U.S.A. is protection of the factory worker while the endangered species is a factory job with a good wage in the safest, cleanest environment in the world. Please, don’t hit us with another mandate, let the midnight ride continue.

Thank you for this opportunity and I look forward to answering any questions you may have.

Senator ALEXANDER. Thank you, Mr. O’Shaughnessy.

And thanks to all four of you. And I never anticipated I would meet the president of a company founded by Paul Revere. That is a pretty—that is impressive.

Senator Salazar.

Senator SALAZAR. Thank you very much, Senator Alexander.

And thank you, as well, to the panelists for giving us such diverse perspectives on the issue of the RPS.

My question is to you, Don Furman. Mr. Furman, you heard the comments from another energy producer, Mr. Bowers, where he comments that we ought not to have a national renewable energy portfolio standard. And, as his argument goes, and the argument of Mr. O’Shaughnessy and some of the panelists from before, the view is that we have such diversity across the Nation, in terms of what is available for renewable energy sources, that it would make no sense to have this national standard that has been dealt with by this Senate before. How would you respond to Mr. Bowers, Mr. Furman?

Mr. FURMAN. Thank you, Senator Salazar.

A couple of ways. One is, while there is a lot of diversity across the country, there are renewable resources in almost every part of the country. The Southeast has a lot of renewable resources in the form of biomass. And I’m not just talking about the potential of burning—co-firing biomass in large power plants; there are, you

know, specifically—specific designed plants that will burn biomass much more efficiently.

I think the other thing that is frequently missed is the concept of a national trading system. If you were to put in place—I mean, from our standpoint, the benefits of an RPS are that it creates a platform in which you can allow market forces to work. And if every utility has a requirement to either acquire renewable resources or acquire the credits from others who do, you create a market-based solution where only the most cost-effective, the most environmentally sound projects will get built. That's in contrast to the system we have right now with tax credits, which, besides the fact that they're politically undependable—let me just put it that way—the other problem is, every—you know, a wind plant on top of the Smoky Mountain National Park is going to get the same tax credit as a wind plant in the middle of Wyoming that nobody's going to see. And I think one of the things is that we would see in a—with an RPS and combined with a trading system is that you would be able to smooth out those inequities across the country.

Senator SALAZAR. And, Mr. Furman, how would you respond to this notion and reality that we're dealing with that we have 18 States that have already passed a renewable energy standard? And I'm sure there are many more States on the way. Mr. O'Shaughnessy's own State is pursuing that. So how—what are the practical implications of having 50 different sets of those kinds of standards around the country to a power generating company like yours?

Mr. FURMAN. For us, it's particularly difficult. And we're a little bit different from some of the other multi-state utilities, in that we're not a holding company with operating companies. And I won't go into the technical aspects of that. But, essentially, we are subject to an RPS currently imposed by the State of California. We serve northern California. We don't have an RPS in the State of Utah. Utah considered an RPS, but they've made a policy decision not to require that. And yet our six State system serves all six of those States, and we recover our costs through State regulation in all six of those States.

We have not faced this yet, but one of the nightmares that we are concerned about is, we comply with an RPS mandate in one State, and another State says, "Wait a minute, I didn't tell you to do that. I'm not going to allow you to recover those costs." And, again, I want to emphasize, we haven't gotten to that point with our State commissions, but it's not hard to imagine that sort of a situation emerging.

I guess a corollary to that, if I could continue, is that I think this is a national issue. And that's what I tried to emphasize in the beginning of my remarks. And, for that matter, the whole issue of carbon is a global issue. And it is something that I think is suitable to national policy. And rather than having 50 different State legislatures making 50 different policies, it just makes a lot of sense to me, from a public policy standpoint, in adhering to principles of federalism, that the Federal Government would, you know, be the one to step forward and establish policy.

Senator SALAZAR. Mr. Bowers, to make sure that we give you equal time, from your point of view, why are the comments that

Mr. Furman talked about in error? You don't believe we ought to have a national RPS, and you talk about the uniqueness of the Southern, or Southeastern, part of the Nation. Tell us why you think he's wrong.

Mr. BOWERS. Well, I would add that the transference of credit trading—our job, in the Southeast, is to add generation resources that provide power for our local customers. And to pay penalties under—or buy credits from other parts of the country transfers funds to those regions without adding a single kilowatt to serve our customers.

We do believe that local—in contrast to a national issue, we think the whole renewables discussion should be done at the State level. It's about a regional availability of the regional resources available to a local utility company, and, I think, best served at the State level.

Senator SALAZAR. Does it bother you that perhaps—and this'll be my last question, Mr. Alexander; I see my time is up—that, within your own region of service, that, over time, you may end up having three or four different sets of standards that you're having to deal with, based on what happens within the respective states that you serve?

Mr. BOWERS. Sir, we already operate across four States, and we have to deal with four state commissions. And so, we're pretty accustomed to dealing with the issues in different states.

Senator SALAZAR. Okay.

Thank you.

Senator ALEXANDER. Thank you, Senator Salazar.

Mr. Furman, in your testimony you said that your company is mainly coal and hydro, which works pretty well. But you urge more renewable fuels. And you say renewable energy facilities, especially wind generation, can be placed in service relatively quickly. And then you cite some studies about renewable energy that will reduce natural gas costs by billions, \$10 to \$40 billion by 2020. Since wind generation is a major part of that, about—do you have any rough estimate of how many megawatts of energy wind generation will produce, under this plan, by the year 2020 in the United States?

Mr. FURMAN. Thank you, Senator.

I don't. And the reason is, I didn't conduct that study. I was quoting Dr. Wiser's study.

I can tell you what I do know, though. And that is, our experience with wind changed dramatically during the California energy crisis. My company wrote off a billion dollars of excess power costs that we—we recovered a small amount of that eventually, through rates, but most of that our shareholders ate, frankly. It would have been worse had we not had wind resources available to us. What we learned in that experience is how quickly you can put together and put up a wind resource. And I will concede that—

Senator ALEXANDER. How many wind turbines do you have available to you?

Mr. FURMAN. We have, in our integrated resource plan—over the next 10 years, we plan to acquire 1,400 megawatts of renewable resources, which we expect to be predominantly wind, simply because of where we operate.

Senator ALEXANDER. So that's equal to one gas plant or one nuclear power plant or one coal gasification—one coal plant, right?

Mr. FURMAN. One really big one, yes.

And I don't mean to say we're going to place all of our reliance on renewables. To the contrary, we have, just in the last 3 years, either built or acquired or contracted for three major gas-fired plants, and we are looking very seriously, as I said in my comments earlier, at an IGCC or other clean coal technology solution.

Senator ALEXANDER. If I may interrupt, what is your, just, thumbnail response to the commercial viability of this coal gasification—the IGCC? Because we have a bipartisan—we're all tantalized by it, and wonder if we're being realistic about it, or wonder what we can appropriately do to encourage it.

Mr. FURMAN. The technology's been around for a long time.

Senator ALEXANDER. Right.

Mr. FURMAN. There's nothing really new about the technology. I think the big change was when General Electric, and then others, have acquired access to the technology and really changed the terms and conditions under which they're willing to develop and provide that sort of a resource to a utility. In the past, the risk was simply too great for a regulated entity to undertake.

Beyond that, I can't really answer it definitively, because we have not committed to it. We are putting a lot of our own resources into exploring this. And it seems to have—what's interesting about it is the bipartisan support that we get for it from Rocky Mountain States, which are largely coal-based, to our West Coast States, which are much more interested in environmental issues. And it seems to be a place where everybody comes together. And as long as the cost is not prohibitive, it seems to make sense.

Senator ALEXANDER. I wonder if any of the witnesses have an answer. I'm just trying to get a rough idea in my mind where—we're going from a situation where most renewable power is produced by hydroelectric power, right? And what we're talking about there today are standards that would mandate that we would—the non-hydro part of renewable power, which is 1 or 2 percent of the total energy, would go to 10 or 12 or 15 or 20. And all of the testimony suggests that wind is an important part of that, so I wonder if anyone has a wild guess, if we were to adopt the policies being recommended today, about how many megawatts of wind power we could expect to be produced in the United States in the next 10, 15, 20 years. How can we get a sense of that?

Mr. BOWERS. Well, I'll take a crack at that.

Senator ALEXANDER. Yes, sir.

Mr. BOWERS. As we pointed out, we lack the sufficient wind resources of the—elsewhere in the country. Our wind resources are lower in the Southeast. But we have tried to estimate how many wind turbines we would have to install, as a company, to meet a 10-percent RPS. Using the lower wind speeds, it would take us about 5,000 wind turbines, just for our company. It's an enormous undertaking for us. We don't think it's practical.

Senator ALEXANDER. Now, 5,000—

Mr. BOWERS. 9,900 megawatts worth of wind turbines would be required, Senator, for us to comply with the 10-percent RPS.

Senator ALEXANDER. If each wind turbine is a little over one megawatt, that's about 500 square miles of wind turbines.

Mr. BOWERS. It's a lot.

Senator ALEXANDER. Washington D.C. is about 61 square miles, just to give an idea of size.

Mr. Nogee, do you have any idea of what we could reasonably anticipate, under standards like the ones you suggest, of the amount of megawatts that might be produced by wind in the United States, as we look ahead?

Mr. NOGEE. It depends on quite a number of different assumptions, and I would have to check back at our analyses to get the outputs from our analyses. But on a rough—as a rough benchmark, you could expect that a 10-percent national standard would lead to about—between 90,000 and 100,000 megawatts of renewables. So perhaps two-thirds of that—of a 10-percent standard—would be wind.

Now, I would point out that we're looking at about 1½-megawatt turbines typically going in today, and larger sizes on the horizon, particularly for offshore use, where we're looking at 3½-megawatt turbines in the Cape Wind proposal, and they're already looking at 5-megawatt turbines offshore in Europe.

Senator ALEXANDER. Mr. Nogee, shouldn't we be also looking to encourage conservation in this discussion of portfolio standards? And, if so, how should we do it? Customer premises technologies, like fuel cells and photovoltaic systems and inherently clean generation sources, like IGCC and nuclear, as Senator Domenici was suggesting—why should these resources not be included as eligible resources under renewable policies—a portfolio standard?

Mr. NOGEE. I think we need to look at what the various resources need for their development, and issues around what kind of policies make the most sense for different resources. We certainly need to promote energy efficiency in this country. And one policy that could do that would be an energy efficiency performance standard. We are seeing that now being experimented with in a few states. That's certainly a positive direction.

In terms of combining that in one standard with renewables, however, I think there's a mismatch, in terms of combining policies like energy efficiency, where each technology is cost effective on its own, and combining that with supply options, like biomass, geothermal, wind, and solar, where you want to promote a diversity of energy resources, not each of which is cost effective on its own, if you don't count the natural gas savings. We think that it would be best to pursue those independently.

Similarly, for the other technologies, if you're looking at coal gasification, certainly a promising technology, it needs more research and development, we believe. And I think the most interesting ideas to come out of this discussion are that one could diversity one's portfolio, which is, I think we all agree, a major objective of this policy. You diversity one's portfolio by adding more of the resources that already comprise 70 percent of your portfolio. I think that most Wall Street analysts would not consider that policy diversification.

Additionally, there's issues with different levels of subsidies that these resources already get. If you were to eliminate all of the sub-

sidies for fossil and nuclear fuels, and have them all compete, renewables would do very well. But, in fact, renewables are struggling to find market share in an industry where nuclear and fossil fuels have taken the lion's share of subsidies, historically, and continue to get very, very significant subsidies. In that environment, we should treat them separately.

Senator ALEXANDER. Thank you.

Any other comment on that from—Mr. Furman? And then we're going to wrap the hearing up by 4:30.

Mr. FURMAN. Senator, I just wanted to come back on the issue of how much wind is available. There have been estimates—and I think Mr. Nogee already hit the statistic I was going to give—but there have also been estimates of as much as 100,000 megawatts of wind capacity.

The point I really want to make, though, is that a lot of that is in the West. But with a trading system, you can simply over-comply, or you could over-comply with the RPS system in the West, simply because there isn't—I guess I'm responding to Mr. Bower's comment about how much acreage it would take for them to comply in the Southeast. That's using Southeast wind speeds. But if credits were available for them to comply, they would be able to, essentially, take advantage of the wind in the West. And the wind resource in the West, in the Upper Midwest, is tremendous. It's very large.

Senator ALEXANDER. If we're going to have 100,000 wind turbines, or 80,000 or 90,000, covering, I guess, 10,000 square miles of land, would you agree that it might be wise to consider a policy of saying that at least some parts of our country are off limits, so that we could have some parts of the United States where we can look at the landscape and not see a wind turbine?

Mr. FURMAN. Absolutely. And I think wind turbines aren't for every place and every environment. And I think that, in certain situations, visually, they're not desirable. I would agree with that.

Senator ALEXANDER. I want to thank each of you for taking the time to be here and for providing such excellent testimony, both in your written statements and in your oral comments. I can assure you that we'll take it very seriously. Senator Domenici has us working hard on these issues, and we are working in a bipartisan way to try to produce a sensible energy bill this year.

The staff may have some extra questions that they could provide to you quickly. And if you have any comment to them, we'd like to have them. Or if you think of anything else you'd like to say to us, if you can get it in within a few days, we'd appreciate that. We'd appreciate that very much.

Mr. O'Shaughnessy.

Mr. O'SHAUGHNESSY. Well, I just wanted to say that I don't have an oar in the water, as far as these different sources of energy. I don't gain or lose from any one of them. I have a pretty good understanding of the economics of all of them, all of the major ones. To me, it's a major disappointment that wind power doesn't work, aside from the aesthetics problems. It's a major disappointment that the economics are as disastrous as they are, because, when you want to talk about subsidies and understanding about the true economics, you'd better understand who wrote the study that you're

reading. You want to look at independent studies where people don't have an oar in the water concerning the proposals that they're supporting.

I think that you have to look globally. You have to understand that people who talk about ergonomic models on commodities and resources have never got it right. Not ever. And if they ever did, and they gave me the results of those studies, within 2 years I would put Soros to shame in the amount of money that I would control through my ability to trade commodities in this world.

So, there's a lot of uncertainty here. I think the model of having different States doing different things on their own, and containing the disasters that this is leading to, is good economic policy for the United States and for manufacturing.

Senator ALEXANDER. Thank you, Mr. O'Shaughnessy.

And, on that, we'll conclude the hearing. Thank you very much for coming. The hearing is adjourned.

[Whereupon, at 4:30 p.m., the hearing was adjourned.]

APPENDIX

Responses to Additional Questions

RESPONSES OF MR. O'SHAUGHNESSY TO QUESTIONS FROM SENATOR DOMENICI

Question 1. Does greater reliance on renewables affect our competitiveness with other manufacturing nations?

Answer. First, Revere Copper Products and the NAM support a diversified portfolio of energy sources for the generation of electricity that includes affordable renewable power. Renewable power can make a contribution to increasing energy diversity, but in most cases will require federal and state tax support for expansion. Rather than command and control programs such as a portfolio mandate, we strongly believe that the market, assisted by incentive policies and removal of regulatory roadblocks, are far superior allocators of resources for electricity generation that will bring the lowest-cost electricity to consumers.

The answer to question #1, is "yes," but the reasoning is somewhat different depending on whether you project there will be a reduction in natural gas demand because of the RPS (a view is held by most of NAM members who have on-site steam and electric generation); or whether you anticipate, as Revere Copper Products and the majority of NAM members do, that an RPS that depends on wind power would have the perverse consequence of encouraging more future natural gas fired capacity than would otherwise be built (see the answer provided to your question 2. b., below).

One problem in answering this question is that not only do we do not know whether an RPS will reduce domestic gas demand, but how much downward pressure such a demand reduction will have. Generally, lower natural gas demand would mean a lower natural gas price, which would help not only gas-intensive manufacturers and homeowners, but also would have a marginal impact on the price of electricity, which would help all manufacturers. Nevertheless, this traditional model may not be appropriate in the future. During the time frame of the next 15 years, the time proposed to meet the traditional federal RPS of 10 percent, LNG imports into the U.S. will increase and LNG is expected to have become a globally traded commodity. If U.S. powerplants use less natural gas to generate electricity as a result of an RPS, there will be a marginal reduction in the domestic demand for natural gas, which will in turn reduce marginal supply of natural gas—which may be imported LNG. However, it is unclear just how much impact lower LNG imports will have on the domestic natural gas price. In theory, it should, but we simply do not know yet whether in the next decades LNG will set the domestic U.S. natural gas price (so that the domestic natural gas price would not be affected by shifts in domestic demand) and whether or not the LNG market would be so large that the international price will not respond to modest shifts in U.S. demand.

Accordingly, even if an RPS would act to lower natural gas use in electricity generation, no one has a sense how much impact that will have on overall domestic natural gas prices in 10 or 15 years. Certainly, any program that lowers natural gas prices would be a great help to natural gas-dependent manufacturing. But the benefits of any such program could be outweighed by the economic harm caused if that same program raised electricity prices, which would affect all manufacturers and the entire economy. Thus, an RPS or other program must not trade the real risk of raising electricity prices in exchange for perceived benefits, whether that is to increase energy diversity or reduce domestic demand for natural gas in electric generation.

The competitiveness of U.S. manufacturers would be hurt to the extent that a traditional RPS or more diversified portfolio option raises the cost of electricity by mandating technologies or fees that are more expensive than currently idle excess capacity or the lowest priced electricity source options, usually pulverized coal. Such a

program would allow Chinese factories to benefit from the lower cost clean technologies available and use more gas in their combined cycle gas generators. U.S. workers will not be able to compete. Jobs will be lost. Power needs to come from economic, low cost, clean sources such as nuclear, clean coal and gas in order for U.S. based manufacturing to compete.

If the goal of an RPS or other portfolio option is to reduce demand for natural gas in the electricity sector, then it must also ensure that the lowest priced electricity is available to domestic manufacturers. If an RPS cannot keep electricity prices as low as possible, then the better polices to reduce natural gas demand would be to engage in federal policies that ensure more natural gas supply through increasing domestic production and LNG, incentivizing energy efficiency in the public and residential sector as well as the manufacturing sector, and facilitating construction of affordable coal and nuclear facilities, as well as providing incentives for increased use of alternative and renewable energy sources.

Question 2a. Will the intermittent nature of renewable mean poor reliability?

Answer. Yes. There are two kinds of reliability and both will suffer. The first has to do with having generation capacity available whenever it is needed. Intermittent sources by their nature are not always there when they are needed. The second occurs as the shortage will cause generators to feed lower voltages into the transmission lines and power quality and reliability will suffer. This causes manufacturing equipment to trip out, damaging the products being produced. Revere experienced an example of the costs of power failures in the summer of 2003, as area residents turned on air conditioners and quickly reached the limit of the supposed excess power generation capacity in this mid-state region of New York. Although the utility suggested this was caused by Revere equipment, it's funny how it only happens when the weather is hot and generation capacity is severely strained. Revere had no such incidents in the cooler summer of 2004. Reliability of electricity supply is vital to most manufacturers.

Voltage will also drop as wind velocity drops. Reactive power will be needed to bring up voltage and to modulate fluctuations in voltage. These characteristics of wind power run counter to a growing need for increased power quality and reliability for the digital world. Manufacturing needs this to operate ever increasingly sophisticated electronic controls and equipment. The future of competitive manufacturing will depend on the availability of quality power at competitive prices. (Of course, it will also depend on having a tax and legal system conducive to manufacturing.)

Question 2b. Will the intermittent nature of renewable mean greater reliance on natural gas for back-up generation?

Answer. Yes, Revere Copper Products and many NAM members believe that adoption of an RPS will actually *increase* demand for natural gas in the electricity sector. When the wind stops, demand for electricity does not go down, especially on a stifling hot summer afternoon which is all the more uncomfortable because of the lack of wind. Consumers turn on air conditioners to compensate. Then, some other conventional capacity that has been shut down must come up to replace the wind power, as well as to meet the peak demand. Of course, natural gas would be saved if it is a natural gas combined cycle plant that was the conventional power source that had been idled when the wind blows. The real point is that federal policy needs to increase the deployment of pulverized and affordable clean coal and nuclear facilities, so that natural gas is not the least cost option for electricity generators.

The type of generating capacity that is most suited for limited periods of high demand and providing peaking capacity is single-cycle gas turbines. I am aware that natural gas is the preferred back-up power to the wind units in Texas, California and Great Britain. It is possible that in areas with large reserve margins there may be some opportunity to utilize extra coal-fired generation to back-up wind, but that would mean that often the turbines would have to be spinning all the time, just in case the wind drops. This would effectively double the real cost of generating the wind power, and therefore appears to be a less likely choice by generators compared to using natural gas backup power.

Any fair and impartial study of the cost of wind power or other intermittent sources should include the cost of that stand-by power that is not required for conventional sources. Think about that conventional power source having to shut down whenever the wind dies. Much, if not most, of those costs to build, operate and maintain those conventional units continue while the windmills turn. And that cost should also be fairly ascribed to wind power's real costs. Moreover, utilities cannot count wind power or any other intermittent source toward its capacity to meet peak demand unless there is the back up power behind it.

Nevertheless, while an RPS does include several technologies, it is wind that appears to have the most potential to meet a traditional RPS. And, some NAM mem-

bers believe that mandating even wind power will reduce—the use of natural gas units that will be used otherwise for peaking and non-peaking purposes. The ability of wind to be relied on to meet peaking requirements is suspect, but when the wind does blow during peak demand, wind would back out natural gas use. This analysis appears to have particular merit in cases where an electric generator has over-built its natural gas peaking capacity or has not been able to build coal or nuclear capacity to meet base load growth. Revere and other NAM members believe that the better solution for electricity consumers over all is for the Congress to pass the Clear Skies Act and provide other initiatives to promote new coal and nuclear generation. However, once again, an overall increase in electricity costs may outweigh for most manufacturers any benefits the reduced natural gas demand in the electricity sector.

In conclusion, in many cases, an RPS will cause electric generators to build additional natural gas generation or utilize now idle gas generators to provide the necessary back-up power for the mandated intermittent renewable generation. This natural gas fired generation capacity will be in addition to the normal natural gas peaking capacity the generator needs to meet those peak demands on August afternoons. Thus, instead of reducing natural gas demand, an RPS could actually increase it natural gas use in cases where an electric generator can build adequate coal or nuclear generation capacity.

HOW TO IMPROVE THE TRADITIONAL RPS

As indicated in my testimony, Revere Copper Products and the NAM strongly oppose the concept of a federal mandate on energy choice for electric generators, manufacturers and other consumers. Intrusions into the marketplace by previous Congresses and Administrations should be proof enough that such intrusions distort markets, have unintended consequences, waste consumers' money and prove difficult to turn off or improve as favored parties lobby for more rather than less regulation. Accordingly, we urge the Congress to refrain from mandating a nationwide portfolio for electricity sales or generation. The individual states are much better positioned to tailor the political and economic balances for electricity generation power sources particular to their own situation, including current infrastructure and access to renewable or other energy resources.

However, if Congress deems it necessary to pass a one-size-fits-all fuels mandate, then inclusion of every factor that moves the traditional RPS closer to a free market mechanism would be an improvement. From the Revere Copper Product's and the NAM's perspective as consumers of electricity with little ability to pass through additional manufacturing input costs, we would like to see such a federal fuels mandate require that all net direct and indirect real costs (after state and federal tax credits and other incentives) incurred by electricity generators to install and operate qualifying generation be compared to that utility's lowest cost incremental power option, as determined by the local PUC, with full consideration of federal and state emission requirements. If the qualifying generation exceeds the lowest-cost alternative, there should be relief from the mandate to the extent that new sales or generation capacity is built with units that meet all Clean Air Act requirements.

Such an escape value would be a vast improvement over the 1.5 cent K/w tax in earlier RPS proposals, as this new approach would encourage compliance with the very expensive new Clean Air rules with coal while not burdening manufacturers and other electricity consumers with unnecessary costs. In fact, the new Clean Air rules will already raise the cost of pulverized coal electricity generation, thereby increasing the economic attractiveness of renewables, nuclear and advanced coal technologies.

In summary, the Revere Copper Products and the NAM believe a federal RPS or even Generation Diversity Standard (GDS) is an outdated and unnecessary concept that is not only economically harmful, especially in the context of today's competitive world marketplace, it is not needed in light of state and federal tax and other incentive programs and the stringent new Clean Air regulations.

Question 3. What about applying the Federal mandate to incremental generation only?

Answer. Certainly, the smaller the RPS or GDS requirement, the less impact it will have on the economy. Even if the RPS were only applied to the nation's incremental electricity requirements, and even if the percentage stayed at 10 percent, all of the sound arguments against a federal RPS would still obtain. Yes, there would be somewhat less unnecessary additional electricity costs, unfair treatment of some states compared to others and distortion of rational economic decisions. But, does the mere reducing of the economic harm of an RPS turn this lemon into lemonade? And, once this framework is in the federal law, history demonstrates that it would

be significantly easier for future Administrations and Congresses to amplify its size and its faults.

Again, the NAM and Revere Copper Products, believe the new Clean Air rules will increase the cost of pulverized coal electricity generation, and that will be a sufficient incentive, combined with state and local tax incentives, to increase the market penetration of renewables, nuclear and advanced coal technologies for incremental electricity needs.

Question 4. Should credits offered under State programs count toward a Federal mandate?

Answer. The closer a federal mandate approaches state requirements, the better. The individual states are much better positioned to tailor the political and economic balances for electricity generation power sources particular to their own situation, including current infrastructure and access to renewable resources. In fact, imposing a federal mandate as an overlay over the state's inherently more informed decisions is bound to lead to economic waste and unfairness between various states and the manufacturers and other electricity consumers within them.

Question 5. What resources should be included in a GDS if a multi-tier approach is used?

Answer. More choices will always improve the mandate by moving toward the real marketplace. If Congress were to mandate a one-size-fits-all GDS that allows nuclear and clean coal facilities to qualify in a GDS, then that would be an improvement over a traditional RPS. However, the consequence would be that Congress would be favoring every type of electricity generation energy except the most affordable in the near term—most importantly new or renovated pulverized coal facilities. Since such facilities are now required by the EPA under the Clean Air Interstate Rule and the Mercury Rule to meet dramatically lower emissions requirements, Congress would be steering electricity generators away from very clean and very affordable power options, to the detriment of our competitiveness and standard of living.

Question 6. Should there be different levels of credit for different classes of resources?

Answer. Rather than impose a new federal regulatory framework where Congress decides what is best for the marketplace and has to guess about circumstances and technologies many years into the future, it would be highly preferred if the Congress instead encouraged through tax incentives and RD&D efforts the widest variety of energy sources that could then be adjusted as circumstances and technologies change. Changing a GDS, on the other hand, would involve a major political struggle involving many now-advantaged parties, and would always be a political rather than an economically sound program.

Question 7. What should be the States' role in determining resources, tiers and credits?

Answer. A Federal GDS could only be improved if the several states were given the autonomy to use their individual judgment based on their particular circumstances. Accordingly, the NAM would respectfully suggest that the best GDS is a statement that the federal government will not preempt state RPS and GDS programs, and will not impose either on any state that has chosen not to adopt them.

Question 8. Should transmission improvements, storage facilities and demand-side management gains be credited?

Answer. Yes, definitely. If there has to be a GDS, in many cases these factors would be more affordable ways to use energy more efficiently and reduce the dependence on generation.

Question 9. Should the payment of RPS credits by a retail supplier to the DOE be changed to make the DOE pay the retail supplier credits for qualifying investments?

Answer. This is an excellent idea, and would have all the benefits of incentivizing whatever politically correct energy sources Congress chooses at a given time, without increasing electricity costs to the consumer. Perhaps the money to fund this DOE credit program could be raised from new on-shore federal oil and gas receipts or OCS revenues from production off the coasts of states that are willing to accept it, such as Virginia. This concept loses support from consumers like the NAM, however, if the funding source for the DOE credits were to come from some tax on energy.

Question 10. If there is a mandated GDS of 10 percent, how important would tax credits still be to a project's financing?

Answer. It is unclear whether the question refers to today's renewable energy production tax credit or the DOE credit proposed in question 9. If the GDS definition of qualifying generation energy source is very broad, then perhaps wind and biomass would only be built where it makes economic sense to do so. Today, wind

power is rarely being built voluntarily without the federal and sometimes a similar state, tax credit. Thus, it is likely that federal outlays to the renewable energy tax credit will be considerable if there is an RPS, but less in the future if there is no RPS or if a GDS mandate included nuclear and other more affordable technologies.

RESPONSE OF MR. O'SHAUGHNESSY TO QUESTION FROM SENATOR SALAZAR

Question 1. It is very clear from your testimony that you are against a renewable portfolio standard, but I don't believe you have thought this through. First, let me get this straight: your company is already subsidized by the government of New York State, which allows you to buy electricity at a rate less than the average consumer. If you are already subsidized by the state government, why do you think that would change under a renewable portfolio standard? Secondly, I dispute your claim that a federally mandated RPS would increase the cost of electricity to consumers. Mr. Nogee, sitting on this same panel, has hard numbers to prove that costs will not go up, and he is not alone. Models being used by the Union of Concerned Scientists, the Rocky Mountain Institute, and others are modeling oil at about 35 dollars a barrel today and dropping to 25 dollars a barrel by 2010. Natural gas prices follow a similar trend. These numbers are so low that you will have to admit something is wrong with them. Yet even under those models, the price of electricity and the price of natural gas would go down with a renewable portfolio standard. Why are you against cheaper electricity and gas prices?

Answer. Revere is not subsidized by the government of New York State but it was allowed to buy power, at cost-based rates, from a state owned power plant as part of an economic development program. Fortunately, this program has had the effect of protecting manufacturing companies like Revere from the costly transition to deregulated markets in New York and the stranded costs that resulted from the failure of mandated state energy programs of many years ago.

The irony is that the low cost power available to Revere as part of this arrangement is nuclear. Several years ago, the state sold its nuclear generation plants and no longer can supply low cost power outside of a narrow geographic band around its hydro plants. In about two years, the contract that Revere has for competitive cost power will run out and it is not clear that the state will be able to replace it. If I believed for a minute that wind power was truly low cost, you couldn't find anyone who would be more excited because they are being built all around my Rome, New York plant.

By the way, the local utility believes there is excess power available in this area (mid-state) and that a transmission line should be built to transport the alleged excess power available in this region to downstate New York where there is clearly a shortage. This is a perfect example of having to build wind power in locations that are not close to where the shortage occurs. A clean coal or gas plant located closer to New York City would not require anywhere near the same investment for transmission lines to serve those locations from mid-state New York. Of course, as stated in my earlier testimony, the additional transmission costs that are unique to wind power because of its site specific attributes are not included in wind power generation costs as they should be in any fair comparison.

I am also concerned about Revere's customers who are other manufacturing companies located throughout the United States. For example, Revere ships to a manufacturing customer in Tennessee who may ship to a final product manufacturing plant in Alabama. Now that product must compete with a similar product made in China. A federal mandated program burdening them with high cost power just makes it all the more difficult for them to survive.

Putting Revere aside for a moment, consider that the impact on Revere would be similar to the impact on many of the thousands of manufacturing companies located throughout the U.S.A. Most of these are small manufacturing companies like Revere and usually even smaller. However, many of our customers are the large manufacturing companies whose names are familiar to you. We don't want to see the competitive position of their manufacturing facilities in the U.S.A. harmed either.

There are several categories of groups that perform economic and feasibility studies of energy sources . . . all lay claim to developing hard numbers. One group consists of environmental groups who are generally well intentioned but hardly independent since economic realities are not their first priority. A second group consists of manufacturing companies who benefit from alternative energy sources because they produce materials or equipment or fuels used in this sector. The third are utilities. The third group has many players with quite different agendas and are difficult to classify. Utilities will differ based on whether they are generators or transmission and distribution (t&d) companies. Is the generation regulated or "deregulated"? (In fact, deregulation should be termed reregulation.) The same utility or generator can

have different objectives in different states. A "deregulated" generator could be very interested in wind power if the costs are subsidized and its use is mandated so that t&d companies must build transmission lines to their sites. The t&d regulated utilities may not mind that since they are in the business of building lines and recovering the costs in their rates. Finally the ISO must dispatch such power not on an economic basis but to meet the mandate. Yet other utilities may feel that the utter impracticality of renewable power is not good for their local economies but may be inhibited in speaking out because they do not want to appear to be politically incorrect.

The long and short of it is that most of the parties who advocate for renewable power have interests that are not the same as a manufacturing company such as mine which can examine dispassionately the true economics of alternative sources and understand what is real and what is highly improbable. Based on pure economics, renewable power today unfortunately incurs costs much higher than conventional sources. If their costs were lower, governments would not have to mandate, subsidize and surcharge it into use. You would find people like me and my company doing it without you, thank you.

Whenever Revere or any other well-run company that must compete in the real world does an economic analysis, one of the first things we do is list the assumptions made in the analysis. This list grows as the study proceeds. For example, a study that has five pages of data might have one full page of assumptions . . . say 20 items. Hard numbers as a result are extremely rare but what is clear is that in any economic analysis, it is easy to produce a biased result. So you look at the source. What is the self-interest of that source? If you want to know what is good for manufacturing and manufacturing jobs in the U.S.A., ask me or NAM, not the Union of Concerned Scientists or the Rocky Mountain Institute or even a public utility.

My examination of the true economics of wind power is that it (in most cases) represents an economic disaster that cannot be sustained. I further believe that any economic model that cannot be sustained is harmful to the environment. *I've come to believe that since the evolution of renewable power is at a very early stage in its development, mandating renewable power with today's technology is like trying to go the moon in the 1950's.* Someday a country that has a highly industrialized economy that supports a strong military will develop a new technology for renewable power that is clean and economic. This conclusion is based on a belief that only a strong economy can support the research effort that will be required to develop such a source and that it will be the result of a spinoff of military (and space) programs. Whimsical solutions like windmills are hallucinations. Don Quixote need not apply.

Think about the wind blowing and the wind turbines generating. Then the wind stops and conventional power must kick in to replace it. Then the wind starts up again and the conventional power shuts down. Do you send the people at the conventional plant home? Do you dismantle the plant and sell the scrap to recover the capital cost of construction? In the real world, you include the back up costs that are uniquely required (to such an extent) for wind power as part of the wind power costs. This is what the Royal Academy of Engineers considered in its fairly unbiased study that I quoted. The irony is that the most efficient plants to shut down and start up for back up power are gas fired generation plants and not the lower cost large scale nuclear or clean coal plants. Having said all that, there is a place for wind power and the market will find that place if it is not mandated or subsidized or surcharged into an uneconomic application.

RESPONSE OF MR. O'SHAUGHNESSY TO QUESTION FROM SENATOR TALENT

Question 1. If there is a mandated RPS, how would transmission from remote locations be paid for?

Answer. If the RPS is built within a non-competitive state, and the electric utility's rates are regulated by the Public Utility Commission, then the commission would have to presume a federal mandated costs of an RPS, including the back-up power and the transmission as well as the renewable generation facilities, as "just and reasonable" and pass those costs through to the ratepayers. Added to this rate increase for consumers presumably would be a standard rate of return on the capital invested—insult to injury for beleaguered electricity consumers.

Question 2. How should nuclear energy and clean coal through coal gasification be factored into a national RPS?

Answer. The NAM strongly supports federal encouragement of additional nuclear power, including aggressive RD&D of advanced nuclear technologies, and a broad exploration of new technologies to use the nation's abundant and affordable coal reserves. Since the NAM strongly opposes mandating a nation-wide portfolio for elec-

tricity sales or generation, we believe the better policy is for the federal government to encourage all potential sources of energy for electricity generation independently of some arbitrary portfolio requirement.

Of course, if the Congress were to mandate a one-size-fits-all RPS, allowing nuclear and clean coal facilities to qualify would be an improvement, but the consequence would be that the Congress would be favoring every type of electricity generation energy except the most affordable in the near term—most importantly new or renovated pulverized coal facilities. Since such facilities are now required by the EPA under the Clean Air Interstate Rule and the Mercury Rule to meet dramatically lower emissions requirements, the Congress would be steering electricity generators away from very clean and very affordable power options.

Question 3. Should full costs of adding renewable resources and efficiencies, as compared to other sources of energy, be factored into any RPS?

Answer. As you are aware from our testimony, the NAM is very concerned that the proponents of an RPS do not appear to take into account the “hidden” costs of the additional transmission, back-up power, balancing, load following and dispatch costs, and of course, the cost of building three times as much wind power generating capacity as is needed to meet the sales requirement. We found the testimony of the Union of Concerned Scientists to be especially oblivious to these real costs.

The NAM urges the Congress to refrain from mandating a nation-wide portfolio for electricity sales or generation. The individual states are much better positioned to tailor the political and economic balances for electricity generation power sources particular to their own situation, including current infrastructure and access to renewable resources.

However, if there must be a mandated, one-size-fits-all RPS, then of course, inclusion of every factor that moves the RPS closer to a free market mechanism would be an improvement. From the NAM’s perspective as consumers of electricity with little ability to pass through additional costs, we would like to see such a federal RPS require that all net direct and indirect real costs (after state and federal tax credits and other incentives) incurred by electricity generators to install and operate the renewable generation be compared to that utility’s lowest cost incremental power option, as determined by the local PUC, with full consideration of federal and state emission requirements.

In our view, the most appropriate “escape valve” to prevent an RPS from hurting the economy would be to excuse compliance with the RPS if all qualifying generation options exceed the lowest-cost alternative available in the marketplace—whether that is CHP, pulverized coal or demand-side management.

Such an escape value would be a vast improvement over the 1.5 cent K/w tax in earlier proposals, as this new approach would encourage compliance with the very expensive new Clean Air rules with coal while not saddling manufacturers and other electricity consumers with unnecessary costs. In fact, the new Clean Air rules will already raise the cost of pulverized coal electricity generation, thereby increasing the economic attractiveness of renewables, nuclear and advanced coal technologies.

In summary, the NAM believes a federal RPS is an outdated and unnecessary concept that is not only economically harmful especially in the context of today’s competitive world marketplace, it is not need to responsibly encourage renewables in light of the stringent new Clean Air regulations. If the goal of an RPS is really to decrease natural gas demand in electricity generation, then the NAM believes there are more appropriate polices to accomplish that goal that do not have the risk of raising the cost of electricity to all consumers. Better polices to reduce natural gas demand would be to engage in federal policies that ensure more natural gas supply through increasing domestic production and LNG, incentivizing energy efficiency in the public and residential sector as well as the manufacturing sector, and facilitating construction of affordable coal and nuclear facilities, as well as providing incentives for increased use of alternative and renewable energy sources.

Question 4. Would it be more appropriate to apply any national RPS only on generation needed to meet load growth?

Answer. Certainly, the smaller the RPS requirement, the less impact it will have on the economy. Even if the RPS were only applied to the nation’s incremental electricity requirements, and even if the percentage stayed at 10 percent, all of the sound arguments against a federal RPS would still obtain. Yes, there would be somewhat less unnecessary additional electricity costs, unfair treatment of some states compared to others and distortion of rational economic decisions. But, does the mere reducing of the economic harm of an RPS turn this lemon into lemonade? And, once this framework is in the federal law, history demonstrates that it would be significantly easier for future Administrations and Congresses to amplify its size and its faults.

Again, the NAM, the believes the new Clean Air rules will be increasing the cost of pulverized coal electricity generation, and that will be a sufficient incentive, combined with state and local tax incentives, to increase the market penetration of renewables, nuclear and advanced coal technologies for incremental electricity needs.

RESPONSES OF MR. NOGEE TO QUESTIONS FROM SENATOR DOMENICI

Question 1. Shouldn't other clean energy sources be eligible for inclusion in a portfolio standard—State or Federal?

Would you agree with the statement that support for renewables should fit within a much larger public policy objective of:

- diversifying our sources of electric generation;
- reducing environmental impact;
- reducing reliance on oil and natural gas; and
- helping ensure that consumers pay no more than is necessary for their electricity.

If you agree with this statement, shouldn't we also be looking to encourage conservation; customer premises technologies like fuel cells and photovoltaic systems; and inherently clean generation sources like IGCC and nuclear? Should these resources be included as eligible resources under a RPS? If not, why not?

Answer. I would agree that support for renewables should fit with the policy objectives outlined above, along with the objective of increasing use of domestic resources to enhance energy security and economic development, especially in rural areas.

Customer-sited renewable generation, such as fuel cells using renewable fuels and photovoltaic systems, should continue to be eligible in a federal RPS, and continue to be eligible for triple credits, as enacted twice by the Senate. While I would agree that IGCC, advanced nuclear generation, and non-renewable customer sited generation should be encouraged, other mechanisms should be used to encourage these technologies, and they should not be included as eligible resources in an RPS, for the reasons discussed below.

Each of the technologies listed in the question could somewhat reduce reliance on oil and gas. As Dr. Ryan Wiser testified, by reducing the demand for natural gas, they would help reduce its price, as he found that efficiency and renewable energy would do. Dr. Wiser also testified that the price impact from reducing demand is larger in the short-term than it is in the long-term.

Over the long-term, however, the most important economic benefit of the RPS is that it would diversify the fuel sources in our energy portfolio, reducing consumer and industrial energy bills by creating *new competitors* to the coal, gas and nuclear resources that currently constitute about 90 percent of our fuel sources for electricity. Developing advanced technologies that use existing fuels is also important, but does not contribute to the objective of diversifying energy *sources*.

Any new or minimally used fuel whose price is independent of existing fuels would help accomplish that objective. The more that new competitors are available to be rapidly deployed, the less vulnerable our economy is to potential energy supply shortages or interruptions, price spikes, price increases or price manipulation as a result of our current dependence on a limited supply of a limited number of fuels. Renewable resources—including wind, solar, biomass, geothermal, tidal, and wave power—are especially valuable in this respect because they are also domestic, non-interruptible, and nondepletable; because they do not present attractive targets for terrorists; because they avoid the risk of high future environmental and safety regulatory costs; and because they each have the potential for significant expansion as competitors to existing fuels.

Improving the efficiency, the environmental performance, and the safety of technologies that utilize currently dominant fuels is also a very important objective, but accomplishing that objective cannot satisfy the critical national need to develop new competitors to current fuels. Because both objectives—developing new fuel sources, and developing advanced technologies using dominant fuels—are important, one policy, such as the RPS, should not be used to create a zero-sum game where achieving one objective competes with achieving the other objective.

Proposals that would maintain or increase even other subsidies for the dominant resources, and potentially phase out the production tax credit for renewables, compound the concern that including other technologies in the RPS could limit or preclude its effectiveness in developing new competitors. Nuclear generation, for example, continues to receive significant subsidies for fuel enrichment, insurance, security, and waste disposal. A Cato Institute paper found that the insurance subsidy

alone conferred by the Price-Anderson Act is worth as much as \$3.4 billion per year to the nuclear industry.¹

Improving energy efficiency is also a critical national objective, but one that should not compete with or displace the need to develop new supply-side competitors to coal, nuclear and gas. The U.S. needs both improved energy efficiency and new supply options. There are many very inexpensive efficiency options that are not being implemented because of market barriers in the electricity industry. Sound energy policy should ensure that those cost-effective efficiency options are implemented without putting them in competition with and compromising the objective of developing new supply options.

The RPS is designed to help emerging renewable technologies cross over the so-called “valley of death” between R&D and commercial deployment. The RPS lets the market place determine winners and losers by creating a national market with competition among new commercially ready technologies to gain critical field installation and operating experience and achieve initial economies of scale, the RPS helps drive down the costs of the technologies to enable them to increasingly compete with established fuels.

To the extent that Congress wants to utilize competition to meet a standard to further the objectives of developing new renewable energy sources, improve end-use efficiency, or developing advanced technology to utilize today's dominant energy sources, it should create entirely separate standards to meet each of the three objectives. In that way, similar technologies will compete with each other to achieve each of the three objectives, without trading one important objective for another.

Before considering such a competitive mechanism for advanced technologies using today's dominant energy sources, however, we recommend that Congress consider:

- While there are now a number of states that have demonstrated successfully that a renewable standard can work, there is not yet one working state example of an advanced technology standard. Pennsylvania's standard, with a separate tier for non-renewable advanced technologies, is still in the regulatory development phase.
- The RPS creates competition among renewable projects and options because many small projects can compete to fulfill a relatively small piece of the overall load. As Commissioner Richard Morgan pointed out in his oral testimony, it is not clear whether such a mechanism would work effectively with much larger projects. Larger projects would create lumpy additions to utility rates, and are not likely to be financeable using a market-based mechanism such as tradable credits, especially for initial deployment of new technologies.
- We are not aware of any analyses that would help determine appropriate percentages, costs and benefits, or cost cap levels for a standard for advanced technologies.
- To be on a level environmental playing field with renewables, which have very low or zero net carbon emissions, IGCC would have to be coupled with carbon capture and storage.
- An early deployment mechanism, like a portfolio standard, is not a substitute for R&D. Carbon capture and storage still requires significant R&D to determine if it can be effective and economical. Advanced nuclear technologies require considerable R&D to resolve safety, security, waste disposal and economic issues before they are ready to consider for deployment.
- Nothing will foreclose future nuclear options faster and surer than another nuclear accident. The highest nuclear funding priority should be increasing the Nuclear Regulatory Commission's budget for inspection and enforcement.
- While R&D on advanced fossil and nuclear technologies is very important, the paltry sums expended on R&D by the mature energy industries in comparison to other industries² suggests that Congress may be perpetuating an unnecessary and expensive expectation and dependence on federal R&D support. While the graph below* from 1995, the R&D situation, particularly in the electricity industry in the wake of restructuring, has become only worse. Congress may want to consider how to induce greater R&D spending by the energy industry itself, rather than simply increasing subsidies for the well-established fossil and nuclear industries.

¹ Heyes, Anthony. “Determining the Price of Price-Anderson.” *Regulation*, Winter 2002-2003. Available at: <<http://www.cato.org/pubs/regulation/regv25n4/v25n4-8.pdf>>

² RM Margolis, DM Kammen, “Underinvestment: The Energy Technology and R&D Policy Challenge,” 1999 *Science* 285:690-692. <http://ist-Socrates.berkeley.edu/rael/Margolis&Kammen-Science-R&D.pdf>

*The graphs in this statement have been retained in committee files.

Question 2. Are higher prices in store for consumers whose utilities have little ability to generate electricity from renewables?

You make a strong “big picture” case for a national RPS citing job creation, manufacturing opportunities, creating fuel diversity among other advantages. However, there are still states and companies that oppose a renewable mandate because they do not have sufficient solar, wind or biomass sources to meet such a mandate and they believe that it will force ratepayers in their jurisdictions to pay higher rates for electricity because credits must be purchased to meet the mandate. How do you respond to those concerns?

Answer. Thank you. A national renewable electricity standard would not only save money for U.S. consumers as a whole, but would most likely reduce energy bills in every region of the country. The following table illustrates the savings, by census region, from our analyses utilizing the NEMS model, in each of the three scenarios we have run using EIA’s 2004 natural gas price projections. The graph shows the definition of the census regions, along with the savings from a 20 percent national RPS, using UCS assumptions.

CUMULATIVE ENERGY BILL SAVINGS BY U.S. CENSUS REGION

[In billions of dollars]

Census Region	20 Percent by 2020 RPS		10 Percent by 2020 RPS
	UCS Assumptions	EIA Assumptions	
New England	1.4	0.7	1.1
Mid-Atlantic	5.7	2.0	4.0
East North Central	8.4	5.3	6.1
West North Central	2.2	1.2	1.8
South Atlantic	2.9	0.1	4.0
East South Central	1.6	0.9	1.6
West South Central	13.3	8.1	10.5
Mountain	5.0	3.1	2.8
Northwest	2.6	1.7	1.7
California	6	4.2	4.3

Results are in cumulative net present value 2002\$ using a 7 percent real discount rate. Excludes transportation.

Source: UCS, 2005. Based on results from Renewing America’s Economy.

The reasons that all regions can benefit from a national RPS are that a) all regions would see lower natural gas prices for electricity generation as well as for other direct gas consumers b) all regions have some renewable resources, and would likely see an increase in using local resources for generation, c) the national credit trading market created by a national RPS means that all regions can buy renewable energy credits for the same price, and give utilities negotiating leverage over local renewable generators; and d) by achieving economies of scale, the national RPS will reduce the cost of renewable energy technologies throughout the country.

Additionally, while the Southeast may not have as rich a renewable resource base as some other regions, the dearth of renewable resources in that region has sometimes been exaggerated.

For example, Mr. Bower’s testimony for the Southern Company neglected to mention the potential for off-shore wind energy resources. Recent research has found commercially significant wind resources—including the very strongest class 7 winds—off-shore in the Gulf of Mexico and the South Atlantic.³

The Southeast also has significant existing hydropower resources. According to the National Hydro Association, the Southeast as the potential to add 2,941 MW of incremental hydropower at existing dams—second only to the Northwest/Rocky Mountain region.⁴ Mr. Bower’s testimony also neglected other ocean resources, such

³Archer, C. L., and M. Z. Jacobson, *Spatial and temporal distributions of U.S. winds and wind power at 80m derived from measurements*, J. Geophys. Res., 108(D9), 4289, doi:10.1029/2002JD002076, 2003. Available online at: <http://fluid.stanford.edu/lozej/winds/2002JD002076.pdf>.

⁴“Averting Disaster: Keeping the Lights on With Hydropower,” National Hydropower Association Issue Brief, Tables 2 and 3. <http://www.hydro.org/pubs/lights2.asp?t1=index.asp&n1=Publications>

as wave and tidal power, which are proving to be increasingly promising.⁵ Since incremental hydro, as well as off-shore wind, tidal and wave resources are not included in EIA's NEMS data bases, they are not included in either EIA or UCS analyses. Were these resources included, the analyses would show even greater benefits for the Southeast region.

Mr. Bower's testimony included a map of solar resources intended to demonstrate that such resources in the Southeast pale in comparison to the Southwest. In determining the value of solar energy, however, the effective load carrying capability (ELCC)—which reflects the match between solar output and peak electricity demand—can be more important than the measure of direct solar radiation in a region. The ELCC in most of the Southeast is very high, and in some areas of the Southeast is among the highest in the country.⁶

Southeast states currently import fossil fuels from other states and countries. Is it more of a problem for Georgia to import some wind energy from, say, the Midwest or Texas than to continue importing coal from Kentucky, Virginia, Wyoming, and Venezuela? Is it more of a problem for Florida to import some renewable energy from neighboring states than to continue importing coal from nine states plus Columbia, Poland, Venezuela and South Africa?⁷

A national RPS will have other benefits for the Southeast and other regions. By giving utilities the option of buying locally produced renewable resources or importing renewable credits from other states, utilities have more leverage over local producers to help keep costs to a minimum. By creating a national market for renewable energy credits, and encouraging development of each renewable technology where it is most cost-effective, a national RPS maximizes learning effects and economies of scale, driving down renewable energy costs. By improving technology faster, the national RPS makes renewable resources in every region cost-effective sooner than they would be without the RPS.

As noted in my oral testimony, the Southeast, and every region of the U.S., has more renewable electricity potential than most regions have renewable fuels potential. Anyone who likes a national renewable fuels standard should love a national renewable electricity standard.

Question 3. Are other Federal initiatives needed to make a Federal RPS work?

Mr. Nogee, the Energy Information Administration estimates that renewables will meet approximately 3.2 percent of the nation's demand for electricity in 2025. If the federal government mandated a 20 percent standard of electricity from renewables by the end of the next decade, what additional federal incentives may be needed to assist the states and electric utilities to meet the mandate?

Answer. It is important to extend the production tax credit for at least five to ten years, whether the RPS is enacted or not. The financial industry needs predictability and stability in a familiar mechanism to continue to invest in renewable energy, and make the forward investments in manufacturing capability and infrastructure needed to sustain continued growth in the renewable energy industry. The PTC should also be tradable, so that it can be utilized by entities that may not have the tax situation needed to take advantage of the current PTC.

The RPS is intended to be sufficient to accomplish the objective of helping the most commercially ready, cost-effective renewable technologies ramp up deployment and reduce costs. It is not sufficient to accomplish all critical objectives for encouraging the development of new renewable technologies. As recommended by PCAST, R&D on renewable technologies should double over five years. National net metering and interconnection standards are necessary to ensure fair treatment of customer-sited renewables. A national system benefit charge that provided matching funds for state programs would provide an incentive for more states to fund such programs, and more resources to ensure diversity within the renewable resource portfolio of each region. Transmission policies and prices are needed that do not unfairly penalize renewables for their unique characteristics, such as variable output. And to the extent that Congress considers support for traditional infrastructure, such as pipelines or transmission, Congress should consider support for transmission initiatives to regions with particularly rich renewable resources. These initiatives are not absolutely necessary for the RPS to work, but they would enable it to produce even more consumer savings, more economic development benefits, and more diversity of fuel sources.

Question 4. Are EIA's estimates of future use of renewables too pessimistic?

⁵ e.g., Leonard Anderson and Timothy Gardner, "Cities Eye Ocean Waves for Power Supplies," Reuters, Feb 13, 2005. <http://www.reuters.com/newsArticle.jhtml?type=businessNews&storyID=7611884>

⁶ http://www.nrel.gov/ncpv/documents/pv_util.html

⁷ <http://www.eia.doe.gov/cneaf/coal/quarterly/t28p01.txt>

You suggest in your testimony that EIA uses very pessimistic projections of renewable energy costs. Would you explain for the Committee why you believe those projections to be pessimistic?

Answer. We discuss below why most analysts believe that EIA's projections for renewable energy costs and performance are pessimistic. Please note, however, that the question in the header, whether EIA's estimates of future use of renewables are too pessimistic, is a different question, that is more difficult to answer. On the one hand, to the extent that EIA's cost projections are pessimistic, EIA's model will tend to underforecast the use of renewables in the reference case. This problem is compounded by pessimistic forecasts of the likely result of state RPS programs. On the other hand, the NEMS model "builds" the new capacity that is most cost-effective over the life of that capacity. Since most utilities have much shorter planning horizons and payback criteria, particularly since restructuring began, the model will tend to over forecast the extent to which utilities will invest in capital-intensive resources, like renewables, under business as usual.

It is very difficult to know how these tendencies offset each other, and the extent to which EIA's business as usual forecasts of the use of renewables are too high or too low. However, because they utilize pessimistic assumptions about renewable energy costs, we believe that EIA significantly overstates the cost of achieving any given state or federal renewable electricity standard, where the minimum level of renewable use is determined by the standard, not by modeling assumptions.

EIA's projections of renewable energy technology costs and performance are overly pessimistic compared with projections made by the national energy labs, the Electric Power Research Institute, and other renewable energy experts. For example, EIA's cost projections for wind, geothermal, and solar energy technologies are considerably higher than projections recently made by the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) to examine the impact of their renewable energy R&D programs for the FY05 Government Performance Review Act (GPRA).⁸

EIA's projections for wind power in good wind regimes are 1-2 cents/kilowatt-hour higher than the DOE/GPRA projections, as shown in the figure below. EIA also projects that costs for wind will be relatively flat over time, because they assume wind is commercial technology and that modest improvements in performance will be more than offset by higher financing costs. In contrast, DOE/GPRA assumes that wind power will follow the historic trend of continued cost reductions due to increased volumes in manufacturing and research and development that lead to technology advances and improved performance. The figure also shows that the assumptions we used in our most recent national RPS analysis are closer to (but slightly more conservative than) the DOE/GPRA projections.

EIA's model has also been criticized for artificially constraining the growth of renewable energy technologies. For example, EIA has assumed that there is an absolute limit on the penetration of wind energy in any region to ensure reliable grid operation. While EIA has raised this limit several times, EIA's maximum penetration limit has been below levels actually achieved in regions in the European Union.⁹ Recent European research indicates that there are only economic limits to penetration, as the cost of balancing the system increases at higher wind penetration levels, but no absolute limit.¹⁰

Analysts have also critiqued EIA's model for applying unfair economic penalties to renewable energy technologies as their penetration increases. For example, EIA increases the capital cost of wind power by up to 200 percent to reflect resource degradation, transmission network upgrades, and competition with other uses (see figure). EIA's applies the highest cost penalty (a 200 percent increase) to over 90 percent of the total class 4-6 wind potential in the U.S. We do not believe there is any empirical support for this severe of an increase.

In contrast, we assumed a maximum capital cost increase of 50 percent as the penetration of wind increases to 30 percent of a region's electricity. This includes a 20 percent cost increase for integrating wind into the broader electricity system

⁸GPRA assumptions are online at www.eere.energy.gov/ofce_eere/gpра_estimatesjy05.html. These assumptions are an update to assumptions originally made in NEMS by the Interlaboratory Working Group of the five national energy laboratories in *Scenarios for a Clean Energy Future*. The renewable energy cost and performance assumptions were originally developed by the Electric Power Research Institute (EPRI) and recently updated by the National Renewable Energy Laboratory (NREL) in the *Power Technologies Databook 2003* and in the GPRA analysis.

⁹EIA set the limit at 12% in the AEO 2001 and AEO 2002 versions of the model, raised to 20% in AEO 2003, and 40% in AEO 2004 along with higher economic penalties at higher levels of penetration.

¹⁰Soder, L. (2004) 'On limits for wind power generation', *Int. J. Global Energy Issues*, Vol. 21, No. 3, pp. 243-254.

based on a recent analysis for PacifiCorp's Integrated Resource Plan and a 30 percent increase for additional siting and transmission costs based on estimates from wind developers, utilities, and other studies. PacifiCorp's wind integration cost estimate is at the high end of the range of studies that have been completed to date for several utilities.¹¹

EIA also does not include several advanced renewable energy technologies that could be economically viable over the next 20 years. Perhaps, most importantly, they do not include class 3 or offshore wind potential. DOE goal is to develop a low wind speed turbine that is capable of producing electricity for 3 cents/kilowatt-hour by 2012 in class 4 wind areas, without incentives or transmission costs. This low wind speed turbine would also increase the competitiveness of class 3 wind areas, which are available in nearly every state in the U.S. and are often located close to load centers. Wind development is already occurring in class 3 areas in a few places in the Midwestern and Eastern U.S. and in Europe countries like Germany and Denmark. Several European countries are also aggressively pursuing offshore wind development. In addition, EIA does not include potential from enhanced geothermal systems, wave and tidal power, and incremental hydropower expansion at existing dams, and advanced biomass crops that can produce significantly greater yields than today. These resources and technologies could make a contribution to long-term U.S. electricity needs.

EIA has also consistently underestimated natural gas prices over the past decade. The impacts of their gas forecasts are discussed in response to Senator Salazar's question #2.

Question 5. Does a traditional RPS—limited to solar, wind and biomass—impose excessive costs on utilities and their customers?

According to the Electric Power Research Institute, impacts of RPSs can be significant, especially for those companies that depend on coal and other fossil fuels to supply the power delivered to their customers. For example, under a 10% renewable portfolio standard, a large utility with 20,000 megawatts of generation delivering 140,000 gigawatt hours per year of power to customers would need to replace up to 14,000 gigawatt hours per year with renewable energy. If wind was the only economical choice, it would be necessary to build and operate or purchase power from 5000 to 7000 megawatts of wind generation, depending on the wind resource strength. Thus, a single utility's wind energy requirement would approximately double the installed wind capacity in the United States today. This example could also require an investment of about \$5 to \$7 billion in wind facilities; and an additional investment in transmission and control facilities, which would be required to integrate the intermittent wind generation into the grid. Other significant issues include public acceptance, land use, and noise, visual, and avian impacts.

Do you think EPRI's example accurately describes what could happen under a limited traditional RPS?

Answer. Detailed studies by the EIA and by UCS show that a traditional national RPS would not impose costs, let alone excessive costs, on utilities and their customers, but results in savings on both natural gas and electricity bills.

With respect to the hypothetical EPRI example, it is first important to note that a 20,000 MW utility would be a very large utility, equivalent to a utility covering the entire New England region, or the entire state of California.

While the EPRI assumptions might apply in an extreme case, EPRI uses conservative assumptions that exaggerate the amount of wind development that would typically be required to meet the traditional RPS outlined in their example. First, EPRI assumes that the 20,000 MW of capacity belonging to the utility would be operating at an 80 percent load factor. This load factor is considerably higher than the average would likely be for a large utility that has a portfolio with both a mix of electric generation technologies, and baseload and peaking plants. As a result, the overall amount of renewable generation required to meet the standard is high.

Second, the EPRI example assumes that the utility has no existing renewable energy resources that could be used to either meet its requirement (wind, bioenergy, solar) or reduce its baseload (hydroelectric). And utilities in all regions would have the opportunity to import renewable energy credits from other regions.

Third, EPRI assumes that wind resources would be the only renewable energy technology developed by the utility. However, our analyses and EIA find that wind would likely constitute 57 to 66 percent of the renewables developed to meet a national 10 percent RPS, with the remaining development coming from bioenergy, geothermal, landfill gas, and solar technologies. In regions with above-average wind re-

¹¹A more complete description of the assumptions we changed in NEMS for our most recent national RPS analysis is available at: http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=1504.

sources, which would also mean having a large number of above-average wind sites, the percentages would be higher.

Fourth, EPRI assumes that the wind resources developed would have a capacity factor ranging from just 23 percent to 32 percent. Both EIA and the National Renewable Energy Laboratory assume that wind capacity factors, particularly in areas with class 4 to 6 wind speeds, would range from 35 percent to 45 percent. The more pessimistic capacity factors assumed by EPRI result in greater amounts of wind development needed to meet the requirement.

With more realistic assumptions, UCS finds that a utility with a 20,000 MW portfolio would need 1,500 MW to 2,300 MW of wind, either in that utility's territory or somewhere else in the U.S. from which it would import credits, to meet a 10% national RPS. An additional 800 MW to 1,000 MW of other renewable energy sources would be needed to fulfill the utility's RPS requirement. This also conservatively assumes that the utility has no existing renewable energy development that could be used to meet the RPS.

The investment needed to meet these targets depends greatly on projections of renewable technology costs. Using EIA projections, they would remain close to \$1,000/kW. As discussed in question 4, however, we believe those projections are very pessimistic. (EPRI itself, in its Technical Assessment Guide, uses much more optimistic projections of future wind costs than EIA, however.) Some additional investment in transmission and control facilities would be required. These investments are included in the EIA and UCS analyses that find that there would still be net consumer savings from the RPS.

Finally, after all is said and done, the EPRI publication quoted in the question recommends: "Consider Support of Federal RPS: Proactively Develop Resource Definitions and Standards." (p. 4-6)

Public acceptance. Public acceptance is an issue that affects all energy technologies, including coal fuel cycle and power plant siting; gas plants, pipelines, storage facilities and LNG terminals; nuclear power plants and waste storage facilities, and renewables. In some regions, like the northeast, it is difficult to build any type of energy facility. The public acceptance of wind has varied by region, state and specific locality. In general, areas that have been less accepting of other energy facilities, like the northeast, have been less accepting of wind as well.

If the public in the hypothetical utility territory did not accept the full amount of wind needed to meet the full requirement in the hypothetical utility territory, the utility would have the choice of either utilizing other locally available renewable resources or of importing wind or other renewable energy credits from regions where public acceptance is higher.

Land use. In a recent analysis, UCS examined the amount and types of renewable energy resources that would be developed under both a 10 percent and 20 percent by 2020 national RPS. We used the National Energy Modeling System (NEMS), developed and maintained by the U.S. Department of Energy's Energy Information Administration (EIA), and examined the range of costs and benefits for each RPS proposal using EIA projections of renewable energy costs and performance, and using UCS projections for renewable energy costs and performance. The UCS assumptions are close to (but somewhat more conservative than) projections from the Department of Energy's national labs.

Table 1.—COMPARISON OF WIND RESULTS, NATIONAL RPS PROPOSALS

	20 Percent by 2020 RPS		10 Percent by 2020 RPS	
	UCS Assumptions	EIA Assumptions	UCS Assumptions	EIA Assumptions
Total wind power capacity (MW)	132,990	105,480	82,036	56,015
Estimated number of wind turbines*	88,660	70,320	54,691	37,343
Land area requirement**				
Square miles	7,900	6,266	4,873	3,327
Acres	5,055,776	4,009,950	3,118,703	2,129,482
Circle of radius = (miles)	50.1	44.7	39.4	32.6
Percent of contiguous U.S. land area	0.26%	0.21%	0.16%	0.11%
Actual Footprint***				
Square miles	104	82	64	44

Table 1.—COMPARISON OF WIND RESULTS, NATIONAL RPS PROPOSALS—
Continued

	20 Percent by 2020 RPS		10 Percent by 2020 RPS	
	UCS Assumptions	EIA Assumptions	UCS Assumptions	EIA Assumptions
Acres	66,495	52,740	41,018	28,008
Circle of radius = (miles)	5.75	5.11	4.51	3.74
Percent of contiguous U.S. land area	0.003%	0.003%	0.002%	0.001%

* Assumes average wind turbine size of 1.5 MW.

** Assumes wind power development land density of 6.5 MW per square kilometer, based on U.S. EIA documentation for the Annual Energy Outlook 2004.

*** Actual footprint includes wind turbines, transmission tie-ins, and access roads. Source: Personal communication with Tom Gray, American Wind Energy Association, 3/10/2005, and based on input from wind power developers.

In all four scenarios, wind power plays a dominant role in the renewable energy mix. Table 1 lists the total wind power capacity by 2020 under both the 10 percent and 20 percent RPS for each set of assumptions. Table 1 also lists the estimated number of wind turbines needed to reach these capacity levels, the amount of land needed to build these turbines, and the actual footprint (including turbines, transmission line tie-ins, and access roads) of the wind development. Only a small fraction of the contiguous United States's land area—ranging between approximately 0.11 percent and 0.26 percent—would be required for the level of wind development that could occur as a result of a national RPS. The actual footprint would be far less based on current experience, with more than 98 percent of the land area required for a wind facility still available for other uses such as farming and ranching. Figure 1 (see Appendix) illustrates the land area requirements for wind power development under a national RPS compared to the land area of the 48 contiguous states.

The results presented above do not account for the potential of offshore wind power development in the United States, as EIA does not currently include offshore wind resources in NEMS. The U.S. National Renewable Energy Laboratory (NREL) estimates the total offshore wind resource potential to be 908,000 MW (excluding the Gulf of Mexico, Alaska and Hawaii, and Great Lakes).¹² To the extent that offshore wind resources can be developed, the amount of land-based area required for wind development under a national RPS would be reduced.

Additionally, the land use area of fossil plants are often underestimated when the entire fuel cycle, including extraction, refining, transport, generation and waste disposal. At least one study calculates the lifetime fuel-cycle land-use impacts of a coal plant as exceeding the land use of the comparable generation from wind turbines.¹³ Because almost the entire fuel cycle impacts (except manufacturing) for a wind plant are in one location, however, whereas the fuel cycle impacts of a fossil fuel plant are spread over a number of different locations far from each other, the apparent impact of wind energy can be higher. Also, because the wind resource also tends to be higher on ridgelines, the overall visual impact of wind can be higher. Those impacts need to be balanced against the overall impacts of other energy sources, of course.

Avian impacts. There have been significant impacts on raptors at the Altamont, CA wind facility, and unexpected impacts with bats at a few Mid-Atlantic wind farms. Extensive research and mitigation efforts are underway at these sites. The avian impacts of wind energy facilities at most sites, and overall in the industry are very small, especially in comparison with other human sources of bird mortality, such as vehicle collisions, tall buildings, cell phone towers, transmission lines, and house cats. On average, there are 2.3 bird deaths per turbine per year, and that number has been decreasing with more experience and larger turbines. Overall, wind facilities today are responsible for approximately one of every 30,000 bird fa-

¹² Musial, W., *Overview: Potential for Offshore Wind Energy in the Northeast*, Offshore Wind Energy Collaborative Workshop February 10-11, 2005. National Renewable Energy Laboratory. Available online at http://www.mtpc.org/renewableenergy/Owec_pdfs/OWEC-%20Musial.pdf.

¹³ Paul Brophy, "Environmental Advantages to the Utilization of Geothermal Energy," *Renewable Energy*, Vol 10:2/3, Table 3, pp. 374, (1997).

talities from human causes. The fossil fuel cycle also cause enormous impacts on wildlife.

HOW TO IMPROVE THE TRADITIONAL RPS

As you know, there are efforts underway to craft a new kind of RPS that goes beyond the limited boundaries of a few favored traditional renewables and answers the need to increase of fuel diversity for power generation needs. There are many who favor allowing States to proceed to develop their own resource plans without federal interference, but there is also support for a nationalized program.

The following questions explore new approaches to promoting Generation Diversity Standards.

Question 6. In setting target levels for diverse generation resources, one proposal is to place any new resource obligation on new load growth—the “incremental basis” approach.” The main benefit of this approach is that it allows the supplier and market to adjust as generation demand increases. Do you support this approach and why?

Answer. As noted above in question 1, we do not support making different resources eligible for the RPS.

We do not support setting the target level for an RPS based on new load growth, as opposed to the traditional approach of a percentage of overall sales. The objectives of more diversity of fuel supplies, lower environmental impacts, more domestic energy sources and choices, are important in areas where load is growing slowly, or even not at all, as well as for areas in which load is growing quickly. The impact of an RPS based on total sales is already scaled to an extent to be higher in territories where load is growing more quickly.

An optimal scenario, from the perspective of minimizing energy bills, minimizing environmental impacts, and maximizing fuel diversity, would be to utilize energy efficiency to offset all load growth (or perhaps even reduce energy demand) and still utilize an RPS to diversify fuel sources. A scenario in which energy use continues to grow, and an RPS is used to meet some of the load growth, is likely to lead to continued growth in emissions, especially carbon emissions. Such a scenario is incompatible with United States obligations under the Rio Treat signed by President H.W. Bush and with the need to reduce carbon emissions to stabilize carbon concentrations in the atmosphere.

Question 7. If there was a National Power Generation Diversity Standard, should credits offered under a State program also count towards fulfillment of any federal obligations?

Answer. As noted in question one, we do not support adding technologies to a national RPS or creating a national power generation diversity standard. In a federal RPS, credits retired to meet state RPS programs should count towards fulfillment of any federal obligations. Likewise, in a state accepting alternative compliance payments to meet a state credit obligation, the state alternative compliance payments should count towards fulfillment of the same number of federal credit obligations.

Question 8. If a multi-tier approach like the Pennsylvania RPS model was to be used in a National Power Generation Diversity Standard, what kinds of resources should be included?

Answer. As noted in question one, we do not support adding technologies to a national RPS or creating a national power generation diversity standard. Eligible resources should only include renewable resources, as in the two previous renewable portfolio standards that were approved by the Senate.

Question 9. Should there be different levels of credit for different classes of resources?

Answer. As noted in question one, we do not support adding technologies to a national RPS or creating a national power generation diversity standard. We continue to support providing multiple credits to renewable facilities sited in customer facilities. Such distributed generation projects face additional market barriers not faced by bulk power renewables, and generally require more support to be implemented.

Question 10. What should the States' roles be in determining what resources are assigned to what tiers and how much credit each should receive?

Answer. As noted in question one, we do not support a national power generation diversity standard. Congress could consider a separate tier for renewable distributed generation facilities, as some states have done. That option would provide greater certainty that such facilities would be built than providing credit multipliers would, although at potentially higher cost.

Question 11. Should improvements to transmission constraints and new storage facilities, like compressed wind facilities, also be credited under a National Power Generation Diversity Standard if they result in more efficient use of energy? Simi-

larly, should demand-side management gains and other efficiency and conservation efforts be credited?

Answer. As noted in question one, we do not support a national power generation diversity standard. We do not think that storage technologies should receive credit in a renewable portfolio standard. At least with RPS¹ of 20 percent or lower, it should not be necessary to add storage for either reliability or economic reasons. Developers already have to pay any ancillary service costs imposed by their facilities, which should be cost-based charges developed by independent system operators. Eventually, it may be economic for projects to propose storage as an alternative, or to consider adding system storage, but this is not an issue for the near future. Of course, we support continued R&D for advanced storage technologies, as they will eventually be needed to facilitate higher penetration levels of variable output technologies.

Question 12. Under a traditional RPS, a supplier might be obliged to purchase renewable credits from the Secretary of Energy to meet his obligation if he could not generate the requirement or if found that buying it cost more than buying a credit from the Secretary.

What if instead of spending the money on purchasing credits from the Government, which does nothing to increase diversity, the supplier was credited with meeting that obligation through investments in developing new diverse resources that equal the amount of money he would have paid the Government? In other words, should a retail supplier be able to receive credit for investments in renewable or other eligible resources?

Answer. Under a traditional RPS, a supplier has the option of purchasing renewable energy credits from generators, either under long-term contracts or in spot purchases, or of building and owning eligible generation facilities, and using the credits they generate for compliance, or of purchasing credits from the Government at a fixed price. The supplier thus already has the option of investing the developing new renewable resources.

If the question is whether the supplier should receive credit according to dollars invested, rather than according to the megawatt hour output of the eligible facility, I would respond in the negative. In order to create as level a playing field as possible among the potential developers of renewables, all should receive credits annually according to the output of the facility. Awarding credits according to investment is a particularly weak concept, because it would reward non-performing or poorly performing projects. Awarding credits according to facility output is not only fairer, it rewards and incentivizes good facility performance.

With respect to the purchase of credits from the Government, I would not agree that this option does nothing for diversity. The Government should recycle the funds from alternative compliance into the development of renewable facilities, either through purchasing credits in the market to resell as needed, or by auctioning funds to potential developers, or by distributing the money to state renewable energy funds in the state served by the supplier.

Question 13. If there was a National Power Generation Diversity Standard with requirements of up to 10% diverse resources, how important would tax credits still be to a project's finance-ability?

Answer. As noted in Question 1, we do not support adding technologies to a national RPS or creating a national power generation diversity standard. With respect to tax credits and the RPS, please see the response to Question 3 above.

RESPONSES OF MR. NOGEE TO QUESTIONS FROM SENATOR TALENT

Question 1. If we mandate a national renewable portfolio standard, how would the transmission needed to get wind from remote locations, onshore or offshore, to load centers be paid for?

Answer. While new transmission lines and upgrades would be needed to deliver wind power from remote locations to load centers under a national renewable portfolio standard, this situation is not unique to renewable energy or the RPS. Other resources, particularly new coal plants and many natural gas plants, will also need new transmission lines and upgrades.

As discussed above, our national RPS analysis increased the capital cost of wind by up to 50 percent as the penetration of wind increases to 30 percent of regional electricity use to account for the costs of new transmission lines and upgrades and for integrating wind into the electricity system. An additional cost is also applied to interconnect wind to the existing electricity system. These costs are applied on top of a generic cost that EIA applies to all new generation for expanding the transmission system.

Our analysis conservatively allocates 100 percent of the additional capital costs for new bulk transmission lines and upgrades to wind. In reality, other resources (both new and existing power plants) will likely use these lines to transmit power to electricity consumers and should therefore share in the cost of paying for them.

The answer to the question of who pays for new transmission for wind and other resources is likely to vary by region. FERC has been using this approach in trying to implement its standard market design (SMD). For example, the Midwest Independent System Operator (MISO) is developing a methodology that they are planning to file with FERC in May that will likely be a combination of: 1) everyone within the MISO footprint paying for higher voltage "highway" type transmission facilities (345 or 500 kV) that have broader regional grid benefits and 2) specific load paying for lower voltage transmission facilities (115kV) that supply load serving needs. ERCOT is proposing to spread the costs of new transmission to all rate-payers. These approaches provide a relatively equitable approach for allocating costs for new lines to wind and other resources.

In contrast, we do not support proposals requiring "participant funding" of transmission upgrades, which could severely restrict the growth of wind power for years. It would doom hope of building major new power lines, as developers of 50-100 MW wind projects with six month lead times could not hope to finance a \$500 million, 1,000+ MW transmission line with a six-year or more lead time needed to export wind from a windy region. It would also create higher transmission costs for developers of all new projects, but especially for variable output resources like wind. In addition, it would undermine efforts to improve electricity reliability, making it difficult and more expensive to site transmission, expand and improve the grid, and finance new power plants.

We also believe that fair transmission rules are needed to level the playing field for wind power and other renewable resources. This includes eliminating unfair imbalance penalties, allowing for scheduling flexibility, removing multiple charges for transmitting wind over long distances (i.e. pancaked rates), using methods that recognizes the full capacity value of wind, and developing broader regional transmission organizations to optimize dispatch and grid expansion. A recent FERC staff briefing paper shows that effective transmission charges for wind generators under current transmission rules are more than twice as high as high as natural gas combined cycle plants in some parts of the country.¹⁴ The FERC paper, along with papers from AWEA and the National Wind Coordinating Committee, identify some solutions to this problem.¹⁵

Question 2. How should nuclear energy and clean coal through coal gasification be factored into a national renewable portfolio standard?

Answer. As discussed extensively in response to Chairman Domenici's first question, nuclear energy and coal gasification should not be factored into a national portfolio standard.

Question 3. We heard testimony from Mr. Brian O'Shaughnessy, CEO of Revere Copper Products, as to the potentially extraordinary cost of adding wind generation (additional transmission, three times the capacity requirements to meet the sales requirements, plus balancing and load following costs), particularly in areas of the country with low wind speeds. To what extent should the cost of adding renewable resources as compared to other resources, be factored in to any renewables requirement? Should economic dispatch of more efficient generating units also play a role?

Answer. Mr. O'Shaughnessy did not present or cited any specific analyses to back up his claims. Costs for transmission, meeting capacity requirements, balancing and load following costs, and economic dispatch are all already included in the analyses using EIA's NEMS model discussed in my testimony that find that an RPS of 10% by 2020 or 20% by 2020 will reduce both natural gas and electricity bills. As discussed in response to Chairman Domenici's Question 4 above, we believe that EIA's cost assumptions are generally quite pessimistic in these categories.

Question 4. Would it be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet load growth?

Answer. As discussed in response to Chairman Domenici's Question #6 above, we do not believe it would be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet new load growth.

¹⁴Assessing the State of Wind Energy in Wholesale Electricity Markets, FERC Staff Briefing Paper, Docket No. AD-04-13-000, November 2004.

¹⁵National Wind Coordinating Committee, Transmission Planning Principles, February 2004, http://www.nationalwind.org/publications/transmission/Transmission_Planning_Principles.pdf. Christopher Ellison, et. al., A Review and Update Regarding the 2000 AWEA Transmission Access Priority Issues Report, December 2002, online at <http://www.awea.org/policy/documents/Transmissionwhitepaper12-2002.pdf>.

RESPONSES OF MR. NOGEE TO QUESTIONS FROM SENATOR SALAZAR

Question 1. Mr. Nogee, I am very interested in the economic benefits of renewable power. The Union of Concerned Scientists has recently released a report stating that if only 10% of our energy demands came from renewable sources, this would create 91,000 new jobs and would save industrial, business, and home energy consumers \$28.1 billion dollars. Would you please comment on how new American jobs are created and how the country could save money by investing in renewable energy?

Answer. New jobs are created by investment in renewable energy in several ways. First, there are direct jobs in manufacturing renewable energy technologies, as well as in installing and operating them. The Renewable Energy Policy Project has performed a number of analyses breaking down the specific types of jobs created by renewable energy investments and where they will likely be located.¹⁶ Secondly, jobs are created when the renewable energy workers spend their additional income, supplying them with goods and services. Third, jobs are created when energy bill savings are spent in the economy. Our jobs analysis calculates the net jobs created by all three such types of spending.

Renewable energy technologies tend to create more jobs than fossil fuel technologies because they are capital-intensive. Almost all the money for renewable energy is spent on manufacturing equipment, installing it and maintaining it. With biomass, money is spent on fuel, but usually from sources that are within 50 miles of a biomass plant, because it is too expensive to transport biomass electricity fuels for long distances. Renewables thus avoid the need to export cash to import fuel from other states, regions, or countries, keeping the money circulating in the local economy, creating more local jobs.

A renewable standard saves consumers money in several ways. First, some renewable sources, especially wind energy at good sites, is now less expensive than natural gas or coal-fired power plants over the expected lifetimes of the plants. But in an increasingly competitive industry, utilities are reluctant to invest in capital-intensive renewable energy facilities that have long payback periods, even if they eventually pay for themselves. Second, by reducing the demand for fossil fuels, and creating new competitors for the dominant fuel sources, renewables help reduce the price of fossil fuels and restrain the ability of fossil fuel prices to increase in the future. Natural gas therefore costs less for electricity generation, as well as for other purposes, thus benefiting both electricity and natural gas customers. Third, renewable standards will reduce the cost of renewable energy technologies, by creating competition among renewable sources and projects to meet the standard, and by creating economies of scale in manufacturing, installation, operation and maintenance. As small manufactured technologies, renewables are much more susceptible to such economies than are large power plant construction projects.

Question 2. Mr. Nogee, I note with some interest that your organization has run an economic model using the EIA's forecast natural gas prices and found that a 20% renewable portfolio by 2020 would save consumers money and reduce the price of electricity and gas. This is even more fascinating if we take into account the fact that EIA forecast prices are unrealistically low. For example, the EIA projects a barrel of oil to be about \$35 this year when in fact the cost of oil is above \$53 dollars today. Have you examined the benefits of a renewable portfolio if oil is at 50 or even just 40 dollars per barrel? If not, how much improvement do you think we would see?

Answer. We have not examined alternative oil price forecasts, because outside of a few regions, very little oil is used for electricity generation any more. Oil prices tend to be correlated with natural gas prices, however. As illustrated below, EIA has increased its 20-year natural gas price projection, as published in Annual Energy Outlook (AEO), each of the last nine years to conform to new data. EIA and other state and federal agencies regularly use these forecasts to evaluate the costs and benefits of proposed energy policies. Companies also use EIA projections to evaluate long-term investment and technology decisions.

Low natural gas prices make investments in energy efficiency and renewable energy appear more expensive than they really are. For example, a 2001 EIA analysis projected that a national renewable electricity standard of 20 percent by 2020 consumers would cost consumers \$14 billion on their energy bills by 2020. By compar-

¹⁶ Virinder Singh, The Work that Goes Into Renewable Energy, Renewable Energy Policy Project, November 2001. http://repp.org/articles/static/1/binaries/LABOR_FINAL_REV.pdf
 George Sterzinger and Matt Svrcik, Wind Turbine Development: Location of Economic Activity, Renewable Energy Policy Project, Washington, DC, September 2004. <http://repp.org/articles/static/1/binaries/WindLocator.pdf> George Sterzinger and Matt Svrcik, Solar PV Development: Location of Economic Activity, Renewable Energy Policy Project, Washington, DC, January 2005. <http://repp.org/articles/static/1/binaries/SolarLocator.pdf>

son, a 2004 UCS analysis of a 20 percent standard using EIA's assumptions and model projected that consumers would save nearly \$27 billion on total energy bills by 2020. EIA has changed a number of its assumptions between 2001 and 2004, however, most of the difference in energy bill savings is due to changes in natural gas prices.

EIA now projects that natural gas prices will come down to the \$3.50 range over the next five years or so, before gradually increasing again. However, it is also possible that gas prices will remain at current levels. The mid-term price declines are in part premised on opening new sources of supply, like LNG terminals. New LNG terminals could be delayed or canceled however, as a result of public opposition or other factors, which would tend to keep gas prices high.

While EIA has steadily increased its long-term gas forecasts, it's most recent projection in *Annual Energy Outlook 2005* (released in December 2004) is still well below where NYMEX natural gas futures contracts were trading at the time EIA finalized its gas price forecast. According to a recent analysis by Lawrence Berkeley National Lab, NYMEX futures prices are \$1.11 per million Btu higher than the AEO 2005 reference case over the next six years.¹⁷ This is the largest spread between EIA and the futures market that LBL has seen over the past five years. They go on to say that one would have to pay this premium "in order to lock in natural gas prices over the coming six years to replicate the price stability provided intrinsically by fixed-price renewable generation. Fixed-price renewables obviously need not bear this added cost, and moreover can provide price stability for terms well in excess of six years."

Finally, almost all fuel forecasts project relatively smooth average price trajectories for all fuels, while in reality, gas and oil prices are subject to large short-term fluctuations as a result of many factors, such as weather, storage conditions, temporary supply disruptions, price manipulation and other factors. These conditions have led to many periodic, temporary spikes in gas prices that will certainly continue in the future. By locking in fixed prices over an extended period of time, renewables avoid excess costs imposed by short-term volatility and price spikes, which are not reflected in either our or EIA analyses.

RESPONSES OF MR. POPOWSKY TO QUESTIONS FROM SENATOR DOMENICI

Question 1. Why have a Federally-mandated credit and trading program? Mr. Popowsky, your testimony highlights the benefits of the Pennsylvania RPS model and praises its state-tailored design. Yet, you suggest that a minimum federal renewable portfolio standard is needed. Is that because a national minimum standard is necessary for a national credit and trading program to work?

Answer. My testimony addressed the need for a federal RPS because I believe there are certain key resources that potentially have significant national benefits. There are two factors that these technologies have in common. First, they advance America's energy independence and security because they are not dependent on imported fuel. Second, their relatively small size lends to the distribution of these technologies at many points on the electricity grid thereby enhancing reliability and grid security. Most of these resources are just at or near to being commercially competitive. We can ensure that these technologies become fully realized options in states that are either vertically regulated or restructured by including them in a national RPS.

For example, there is one resource, solar electric or photovoltaic (PV) generation, which has significant security and environmental benefits but is unlikely to be cost-competitive with typical generation costs in the near term. Inclusion in a national portfolio standard would likely bring down the unit costs and improve the ability of this resource to meet long-term needs. This is the type of resource that can and should be part of a national portfolio standard.

In addition, in my view, Pennsylvania consumers will benefit if renewable or other non-fossil fuel resources are used to reduce the growing demand—and resulting increased price—for natural gas. The wholesale natural gas market is obviously not confined to Pennsylvania or the mid-Atlantic region, and a reduced reliance on natural gas for electric generation throughout the Nation would benefit both natural gas and electricity consumers. Also, to the extent that renewable resources reduce our reliance on greenhouse gas emitting fossil fuel resources, the rapid development of those alternative resources on a national basis will reduce the potential cost of our future efforts to address global climate change. Clearly, this is not an issue that

¹⁷ Mark Bolinger and Ryan Wiser, Berkeley Lab, "Comparison of AEO 2005 Natural Gas Price Forecast to NYMEX Futures Prices," Memorandum, December 13, 2004.

is limited to Pennsylvania or that can be fully addressed by Pennsylvania or other states on a stand-alone basis.

On the other hand, as I noted in my written testimony, there are resources such as waste coal that are a particular major environmental concern in Pennsylvania, but are probably not relevant to most states. By allowing states to include resources such as waste coal in a separate tier of resources, a state and federal program could work together.

I would also note that there is value to a national credit and trading system for both state and federal RPS programs. The value of a national credit and trading system is that it is efficient and that it can improve market liquidity by standardizing credit labeling. At present, tracking/trading systems are in place in New England and under development in New York and NM. A national system has the potential for substantial efficiencies by eliminating the need for regional trading systems. Further, a national system that objectively registers all useful generation characteristics will eliminate the potential confusion of differing regional designs. This will facilitate the broadest possible markets so that prices are minimized and choices are maximized.

The point of a national generation credits tracking and trading system is that it facilitates liquid markets and reduces costs to consumers. Such a system makes trading simple because all important generation attributes can be listed for buyers to see. Buyers and sellers can establish a price based on the generation attributes that are important to them. What is important may vary from state to state depending on market dynamics or environmental and renewable portfolio compliance requirements. For example, Pennsylvania has tens of thousands of consumers buying green power products from the retail competitive market. Liquidity in the market for renewables is enhanced through a common, trusted labeling of generation attributes.

One model for a national system is the trading systems used in New England and under development in PJM. This is based on the tracking of generation "attributes." Under such a system, a "tag" is created for each megawatt-hour. These tags support regulatory reporting and can be sold to utilities and other entities serving retail load where, for example, renewable energy resources are a valued retail product. From either perspective, attributes like quantities of emissions of specific chemicals (SO_x, NO_x, CO₂, etc.) can be listed. Other attributes that are expected to have market value include fuel sources (coal, nuclear, wind), fuel quantities and fuel mix, etc.

To permit flexibility in complying with state requirements, tags can also be banked by generators or purchasers. This permits the purchaser to use credits from current generation to comply with future requirements. Again, the single tracking system will support differing state choices regarding the time over which credits may be used for compliance. In addition, the cost of a national credit trading system should be substantially lower than for a series of regional systems.

Question 2. Would a Federal credit and trading program create a double subsidy? Many of the eligible resources under most RPS programs also qualify for the federal production tax credit, which is equal to approximately 1.8 cents per kWh. If we were to adopt a federal RPS with a 1.5 cent per kWh cost cap, dually eligible renewable resources could receive over 3 cents per kWh of subsidies. This is roughly the cost of generating electricity from coal or nuclear plants in many parts of the country. How can this double subsidy be justified and does it best serve consumers?

Answer. Congress has established tax credits for several resources, including some resources not currently contemplated for inclusion in portfolio requirements, due to their economic or strategic importance. The continued need for tax credits for selected resources will depend on whether a portfolio requirement causes the selected resources to actually be purchased. In some cases, it may be appropriate to continue both tax credits and portfolio requirements for particular types of resources of great national interest. Put another way, a portfolio requirement that includes a wide variety of resources, including resources that are already competitive in the market, may do little to encourage the competitiveness of more expensive resources like solar energy or hydrogen fuel cells. This realization was one of the factors in Pennsylvania's creation of two tiers under its portfolio system. Accordingly, I recommend that Congress utilize both tax credits and portfolio requirements on a coordinated basis.

Question 3. How do we allow maximum flexibility for State programs? In your testimony about the Pennsylvania Alternative Energy Portfolio and its multi-tier approach to eligible resources you emphasize that each tier carries its own percentage requirement. If a national standard were to be set, such a limitation would be very difficult to justify because every state has unique resources. Allowing each state to mix and match from a broad menu of eligible resources from multiple tiers would create needed flexibility.

What do you think of such an approach?

Answer. I agree that states should be afforded the maximum flexibility under any national RPS. However, a national RPS that includes too broad a list of resources would have only a limited impact on each resource. I would urge that any national standard be based on a fairly limited set of critical resources as discussed in my answer to Question 1.

As I emphasized in my written testimony, a national RPS should complement, rather than supplant, individual state decisions. For example, a national RPS could establish a requirement related to solar, wind and hydrogen-fueled distributed generation equipment but explicitly not limit any state's ability to establish more extensive requirements for those resources and for any additional resources that the state believes are worthy of inclusion under an additional tier determined by state law.

Question 4. Would it be useful to have a general Federal directive to formulate programs in lieu of a Federal mandate? Some argue that given the interesting and creative steps some states, like Pennsylvania for example, are taking to ensure a diversification of generation resources, it would be better to let States and regions develop their own resource plans *before* a national mandate was imposed. What if there was a PURPA-like requirement on States to develop generation resource diversification standards by a date certain? Do you see drawbacks to that idea?

Answer. The focus on state decisions is consistent with my preference for maximum flexibility. I believe, however, that Congress should consider whether there are some resources of such great national importance that they should be included in a "baseline" federal portfolio standard. The individual states could then build on that baseline, for example, through a second tier of state or regional requirements in the manner I described above.

In my experience, the PURPA approach of requiring states to consider various policy issues has not been particularly useful. If Congress were to mandate actual implementation of a resource diversification standard, rather than just consideration of such a standard, it would have a greater impact. It would probably be necessary, however, for Congress to give at least some guidance to states on the type and level of resources that should be included in the state standards.

HOW TO IMPROVE THE TRADITIONAL RPS

As you know, there are efforts underway to craft a new kind of RPS that goes beyond the limited boundaries of a few favored traditional renewables and answers the need to increase of fuel diversity for power generation needs. There are many who favor allowing States to proceed to develop their own resource plans without federal interference, but there is also support for a nationalized program.

The following questions explore new approaches to promoting Generation Diversity Standards.

Question 5. In setting target levels for diverse generation resources, one proposal is to place any new resource obligation on new load growth—the "incremental basis" approach. The main benefit of this approach is that it allows the supplier and market to adjust as generation demand increases. Do you support this approach and why?

Answer. No, I do not support this approach. Load growth can have a variety of impacts on the electrical system. Depending on these impacts, only certain types of generating resources can satisfy the additional needs. If only used to meet load growth, the expansion of portfolio resources is likely to be slow and will certainly be unpredictable. This will continue to hamper the development of market competitiveness for these technologies and will reduce the security benefit of key resources. On the other hand, portfolio resources will not always be suitable to meet those needs but are almost always suitable for meeting some portion of existing demand.

Not all load growth is the same. The specific requirements created by load growth naturally limit which type of generation is built. In practice, new generation requirements fall into one of three performance categories, depending on which specific demands that load growth place on the network. These three categories are baseload, intermediate or peaking. It is reasonably accurate to generalize that baseload generation runs almost all of the time, intermediate generation supports load during on-peak periods and peaking generation only operates at times of extreme demand. In general, different types of generation are used to satisfy these separate operating requirements. It is extremely inefficient to meet a specific performance requirement, such as a need for new peaking resources, with a plant designed as a baseload or intermediate resource. Thus, portfolio-eligible resources can only fill certain roles just as is the case with any other generating technology. The conclusion of this must be that portfolio resources will be introduced only slowly and on an

irregular cycle if they are just used to meet load growth because they can also only be added where their operating characteristics meet specific system requirements.

Question 6. If there was a National Power Generation Diversity Standard, should credits offered under a State program also count towards fulfillment of any federal obligations?

Answer. Yes. To the extent that a particular resource qualifies under both a federal and state RPS that resource should be counted toward meeting both standards. I do not believe that it would be appropriate for a federal RPS to create a double compliance requirement for generation providers. Thus, for example, if both a state and national RPS required that 1% of all generation be from solar energy sources, then that requirement should be met by a total resource of 1%, not 2%

Question 7. If a multi-tier approach like the Pennsylvania RPS model was to be used in a National Power Generation Diversity Standard, what kinds of resources should be included?

Answer. As I have indicated, I believe that a national RPS should focus on a small number of key resources that have particular environmental and security benefits. If Congress finds that a two or more tier system is appropriate, I would also suggest that subsequent tiers include a limited compliance requirement covering only a limited number of core resources. Within each tier I also urge that states be provided with the discretion to both increase the requirement related to the core resources and include additional generating technologies.

I suggest that the first tier include only technologies that are not fully competitive in the energy market or have particular value as distributed resources. These would include solar, wind, and hydrogen fuel cells. The logic of a second tier is to establish a requirement for resources that have other values. For example, Pennsylvania included waste coal generation because it addresses a particular environmental problem in this state. I suggest that the resources in a second tier be determined on a state or regional basis.

Question 8. Should there be different levels of credit for different classes of resources?

Answer. The simplest approach is to have every credit represent one megawatt-hour of generation. I urge that any national RPS be based on a one megawatt-hour to one credit system to make market transactions easy to understand and easily subjected to comparative analysis by market participants.

There is an alternative approach in which some RPS methods propose that specific resources, photovoltaic energy in New Jersey's case, receive multiple credits. While such a choice may be appropriate for an individual state, I would not urge that this be done within a national RPS.

Question 9. What should the States' roles be in determining what resources are assigned to what tiers and how much credit each should receive?

Answer. As I mentioned elsewhere, I believe Congress should set a minimum level of standards and credits for a basic set of resources that Congress determines should be part of the national portfolio standard. Beyond that, it should be up to the states to determine whether to require additional amounts of the nationally designated resources and/or to establish a second tier of resources that are important to that state or region. Pennsylvania has huge amounts of waste coal and an under-developed solar market. Pennsylvania has determined that it is important to support energy development in both of these areas. In contrast, Florida has substantial existing solar thermal resources and no coal waste whatsoever. Florida, or other southern states, may decide to promote development of a completely different resource mix. Thus, the decision as to which resources are to be included in a second tier and how much credit they should receive should be left to the states.

Question 10. Should improvements to transmission constraints and new storage facilities, like compressed wind facilities, also be credited under a National Power Generation Diversity Standard if they result in more efficient use of energy? Similarly, should demand-side management gains and other efficiency and conservation efforts be credited?

Answer. I do not believe that removal of transmission constraints should be included in a generation diversity standard. While removal of such constraints can certainly be beneficial to consumers, I do not see this as the sort of resource that should be considered in conjunction with the critical generation resources that logically fall within a portfolio standard. Transmission issues, I believe, are better addressed through the type of regional transmission expansion planning model that is in place in PJM.

Storage facilities could qualify for inclusion in a federal generation diversity standard if Congress concludes that this is the type of resource that should be encouraged on a national basis. Storage facilities can provide ancillary services such as quick-response reserves or voltage support. On the other hand, as energy re-

sources, some storage systems may consume more electricity than they produce. To the extent that these technologies either provide a unique security value or require support to further develop their markets, they could fall be in the same categories as other generation technologies that fall under a portfolio requirement.

As to the inclusion of demand side response, this may be the type of resource that is better addressed on a state-by-state basis. Pennsylvania, which has never had substantial state-wide demand response programs, has included energy efficiency and demand response within the second tier of its portfolio requirement. Other states may have more effectively developed their demand markets and will not see the sort of additional value that warrants inclusion of demand programs in their portfolio requirements. It might also be difficult to measure and trade demand response resources in one state against generation resources in another.

Having said that, I continue to believe that, from a consumer perspective, the cheapest kilowatt hour is the kilowatt hour that is not used. I also believe that we, as a Nation, have done far too little to take advantage of low-cost conservation and energy efficiency methods that are vastly less expensive and more environmentally beneficial than construction and operation of virtually any power plant. That is why, for example, I testified in favor of new appliance efficiency standards in Pennsylvania and would do the same at the federal level. The question is not whether conservation and energy efficiency are the most economic way to reduce energy costs; I believe they are. The question is whether they fit well into a national generation portfolio standard and, if so, how that will work.

Question 11. Under a traditional MPS, a supplier might be obliged to purchase renewable credits from the Secretary of Energy to meet his obligation if he could not generate the requirement or if found that buying it cost more than buying a credit from the Secretary.

What if instead of spending the money on purchasing credits from the Government, which does nothing to increase diversity, the supplier was credited with meeting that obligation through investments in developing new diverse resources that equal the amount of money he would have paid the Government? In other words, should a retail supplier be able to receive credit for investments in renewable or other eligible resources?

Answer. I agree that it may be more useful to promote direct energy investment rather than require alternative compliance payments made in lieu of purchasing credits simply go to a government agency. In Pennsylvania, in fact, alternative compliance payments under our portfolio standard will be paid to our state sustainable energy development funds, along the lines suggested in your question. The difference is that under the Pennsylvania program, the supplier turns the money over to an independent sustainable energy fund, rather than allowing the money to be invested directly by the non-complying supplier. I think it would be preferable to have the money paid to an independent entity, as is done in Pennsylvania, which can then direct the payments to development of resources that are of the greatest public value.

Question 12. If there was a National Power Generation Diversity Standard with requirements of up to 10% diverse resources, how important would tax credits still be to a project's ability to secure financing?

Answer. Only if the portfolio is designed to ensure that all included resources are purchased is the portfolio as likely have an impact that is as great as a direct, targeted tax credit. As I indicated in my response to Question 2 above, the inclusion of a generating resource in a portfolio requirement does not guarantee that resource will be purchased. If a national RPS is established, I suggest that Congress examine the overall benefits of the resources that are included plus the extent to which those resources will actually be purchased and consider these factors to determine whether tax credits are also appropriate.

RESPONSES OF MR. POPOWSKY TO QUESTIONS FROM SENATOR TALENT

Question 1. If we mandate a national renewable portfolio standard, how would the transmission needed to get wind from remote locations, onshore or offshore, to load centers be paid for?

Answer. I support an approach under which generation developers pay the costs of interconnection, including costs that are incurred to upgrade the grid because of the additional flows of power, except to the extent that grid reliability is improved by the interconnection. That said, there is a need for standard interconnection procedures to ensure that interconnecting generators pay only what is necessary for safety and reliability.

The allocation of transmission costs in areas that fall within Regional Transmission Organizations is in the process of being resolved. For example, in PJM, all

generation that requests interconnection must pay all costs that would not otherwise occur. This "but for" test is an approach that I support because it protects consumers from absorbing certain transmission system costs that do not directly benefit them.

On the other hand, I believe all entities that use the transmission system and all consumers should share in the costs of transmission improvements that are necessary to ensure reliability or other benefits to the system as a whole. Again, I would point to the PJM Regional Transmission Expansion Plan as a successful, coordinated method of addressing reliability and economic transmission needs on a systematic basis. Under the PJM methodology, the costs of transmission improvements that are intended to relieve economic congestion in specific areas are assigned to the customers who benefit.

Question 2. How should nuclear energy and clean coal through coal gasification be factored into a national renewable portfolio standard?

Answer. In Pennsylvania, integrated combined coal gasification is included as a Tier Two resource. Coal has long been a vital indigenous resource in Pennsylvania, and the state's desire to encourage development of this important type of clean coal technology justifies its inclusion in the Pennsylvania portfolio standard.

I would not, however, recommend the inclusion of large baseload units such as coal gasification or nuclear units in a national resource diversification standard. Rather, as I noted earlier, I would confine the national standard to smaller dispersed generation resources that Congress concludes have particular value to the Nation as a whole and have not traditionally been part of the resource mix.

In any case, I do not think the problems of nuclear power would be resolved by inclusion in a portfolio standard. The greatest problem, I believe, is the enormous financial risk involved in developing such a project, particularly in a competitive generation market. To the extent that Congress wishes to encourage the development of a new generation of nuclear power plants, then I think that direct tax credits would make more sense than including such resources in a nationwide portfolio standard.

Question 3. We heard testimony from Mr. Brian O'Shaughnessy, CEO of Revere Copper Products, as to the potentially extraordinary cost of adding wind generation (additional transmission, three times the capacity requirements to meet the sales requirements, plus balancing and load following costs), particularly in areas of the country with low wind speeds. To what extent should the cost of adding renewable resources as compared to other resources, be factored in to any renewables requirement? Should economic dispatch of more efficient generating units also play a role?

Answer. There is no question that wind power is limited as to which sites are appropriate, though this is true of several other types of generation as well. In practice, while Pennsylvania has more wind generation in service or under construction than any other eastern state, most areas of the state are unsuitable for siting wind. One critical factor restricting where wind is sited is the available wind resource. Wind resource simply refers to the consistency and strength with which the wind blows in a location. I do not expect wind generation to be sited in areas where wind resources are poor because that would result in such low production that the wind farm would be uneconomic no matter what the alternative energy price. On the other hand, many areas in the mid-west have broad areas in which the wind resource is very robust and will exceed local requirements. Thus, I anticipate that, rather than siting wind where it doesn't make economic sense, portfolio requirements will be satisfied through the purchase of credits from areas where wind resources are plentiful. In this spirit, the requirements that Pennsylvania imposes on utilities may be satisfied from anywhere in the applicable Regional Transmission Organization.

With respect to cost, the benefit of a robust regional or national portfolio standard, with a credit and tracking system, is that it makes it more likely that suppliers and consumers will have access to the lowest cost resources that are available in a wider market area. As I indicated above, I believe that interconnection costs for wind or any other generation resource should be paid by the developer. This will tend to raise the costs of wind. However, the logic of a portfolio system is that requirements must be met from among the resources accepted in that portfolio. If wind is too expensive, compared to other qualifying generation sources, then wind will not be used.

Economic dispatch is the norm in both Regional Transmission Organizations and in states that continue to be vertically integrated. Most resources will continue to be purchased from an energy market where prices are set through economic dispatch or where prices in private energy contracts are guided by that market price. Unless portfolio requirements expand to cover a substantial portion of generation delivered to customers, overall energy costs, including portfolio costs, will tend to-

ward the market price. There are two reasons for this. First, the average cost of some portfolio resources might not be significantly different from the average cost of energy, particularly in those regions in which energy prices have been driven up by high natural gas prices. For example, wind generation has become increasingly competitive with other types of energy. Second, even where some portfolio resources like solar energy are substantially more expensive than typical market prices, the total price differs only slightly because the amount of high priced solar energy is only a tiny fraction of the total energy. Further, I anticipate that portfolio resources will be subject to selection on the basis of economic efficiency so that the least expensive qualifying resources will be used to satisfy the requirements.

Question 4. Would it be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet load growth?

Answer. As I discussed in my response to Senator Domenici's Question 5, I do not think it would be appropriate to have portfolio resources used only to meet load growth. If this were the only area in which portfolio resources could qualify, the result is likely to be that their growth will be slow and volatile.

The specific requirements created by load growth naturally limit which type of generation are built. In practice, new generation requirements fall into one of three performance categories, depending on which specific demands that load growth place on the network. These three categories are baseload, intermediate or peaking. It is reasonably accurate to generalize that baseload generation runs almost all of the time, intermediate generation supports load during on-peak periods and peaking generation only operates at times of extreme demand. In general, different types of generation are used to satisfy these separate operating requirements. It is extremely inefficient to meet a specific performance requirement, such as a need for new peaking resources, with a plant designed as a baseload or intermediate resource. Thus, portfolio-eligible resources can only fill certain roles just as is the case with any other generating technology. The conclusion of this must be that portfolio resources will be introduced only slowly and on an irregular cycle if they are only used to meet load growth because they can also only be added where their operating characteristics meet specific system requirements.

RESPONSES OF DR. WISER TO QUESTIONS FROM SENATOR DOMENICI

Question 1. What is the mix of energy savings expected from renewables and efficiency improvements? Dr. Wiser vast improvements in energy efficiency have been realized in our economy since the mid-1970's. EIA has shown that energy use per dollar of GDP has declined significantly. Between 1973 and 2000 energy consumption fell from 13,910 Btu to 6,580 Btus per \$1 dollar of GDP—more than a 50% increase in energy efficiency. Can you describe for the Committee exactly what further improvements in energy efficiency can be realized and how? Also, can you describe where and to what extent renewable energy can reduce demand for conventionally generated electricity?

Answer. There is little doubt that our nation has seen substantial improvements in energy efficiency over the course of the last three decades. These improvements have come from a variety of sources including, for example, state programs to support energy efficiency and federal programs that have established minimum efficiency standards for new appliances. Energy intensity (energy use per dollar of GDP) has also fallen as our economy has shifted away from more energy-intensive sectors. On a going forward basis, it is difficult to estimate with precision how much incremental energy efficiency is technically or economically feasible. However, it is evident that this potential is significant.

As just one example, in its Fifth Power Plan, the Northwest Power and Conservation Council (NWPCC) notes that energy efficiency investments have saved the Northwest (Oregon, Washington, Idaho, Montana) 10-12% of the region's electricity needs since 1978, or nearly 2500 average megawatts of capacity (aMW), at an average cost of just 2.5 cents/kWh. Much of this has come from state and regional programs, but a significant amount also derived from federal appliance efficiency standards. On a going forward basis, the NWPCC identifies 4600 aMW of additional technically available potential, of which 2800 aMW is estimated to be cost effective. This represents approximately half of all otherwise-expected load growth over the next 20 years. Those 2800 aMW are predicted to be available at an average cost of just 2.4 cents/kWh. The most significant savings are expected to come from residential and commercial lighting, as well as industrial energy savings.

Similar studies have been conducted in other regions. Though the exact savings potential varies, as does the source of those savings, most studies reveal significant additional potential. A study completed in 2003 for the New York State Energy Re-

search and Development Authority, for example, found that even with low energy costs assumed, the economic potential for energy efficiency would be over 50,000 GWh by 2022, representing over 12,000 MW of summer peak capacity. Studies in California have found that aggressive investment in energy efficiency could cut load growth in half over the next two decades. I would be happy to point the Committee to studies that have been conducted on these matters.

Most would agree that achieving these savings, or even a fraction of these savings, will require policy intervention. Standard options include state and local financial incentives, building codes and standards, federal efficiency standards, federal and state tax incentives, and changes in utility rate design that breaks the link between electricity sales and utility profits. More recently, as the Committee knows, there has been some exploration of energy efficiency portfolio standards.

On renewables potential and costs, I would direct the Committee to the National Renewable Energy Laboratory, the nation's premier research institute on this topic. As with energy efficiency, there is uncertainty over exactly how much technical and economic potential exists in the U.S. If transmission expansion needs can be met, however, it is clear that the technical potential for wind power alone is vast. It is true that wind power resources are not spread evenly across the United States, but all regions have at least some potential to utilize local sources of renewable energy.

Use of renewable energy will offset conventional fuels. Recent analysis by the Energy Information Administration shows that renewable generation will displace both natural gas and coal generation, in approximately equal fractions. For natural gas specifically, assessments of federal RPS proposals have shown that gas displacement could be as high as 3 to 4 quadrillion Btu (Quads) a year by 2020, or 10% of projected national gas consumption. Less aggressive levels of national deployment are found to reduce gas consumption by as much as 1.5 Quads, or 4% of total projected demand in 2020, with a mean reduction across studies of 0.7 Quads (2%). Of course, achieving significant growth in renewable energy supply (in the 10-20% range for non-hydro renewables) will require transmission investments to access the nation's most robust resource areas.

Question 2. In setting target levels for diverse generation resources, one proposal is to place any new resource obligation on new load growth—the “incremental basis” approach. The main benefit of this approach is that it allows the supplier and market to adjust as generation demand increases. Do you support this approach and why?

Answer. This approach has not been used in any U.S. state, or in any other country that has developed a renewables portfolio standard (UK, Italy, Belgium, Australia, Japan, Sweden). That is not to say that the idea is without merit, and I do see some advantages to this approach. The key difficulty, in my view, comes in those states that have moved or are moving towards retail electricity competition. In these states, individual electricity suppliers experience substantial changes in load growth from one year to the next. Application of a standard to “incremental” load may be challenging in this instance because load for any single retail supplier could increase from one year to the next, only to then decrease the following year (as load switches to a different competitive supplier), and then increase again the next year. Applying a portfolio standard to load growth in this instance may be an administrative challenge, and would certainly require additional thought. It perhaps should also be noted that applying a standard to load growth ensures that the standard cannot increase annually by more than the underlying growth in load, which may limit the impact of a standard especially if the standard includes non-renewable sources such as coal gasification and nuclear power.

Question 3. If there was a National Power Generation Diversity Standard, should credits offered under a State program also count towards fulfillment of any federal obligations?

Answer. I am not prepared to take a policy position on this topic. However, I would note that states have designed their RPS policies differently, in part reflecting different regional circumstances and goals. Some states clearly want to take an aggressive stance on renewable energy deployment, while others want to encourage preferred, local renewable resources (e.g., solar). In any case, states may wish to go above and beyond any federal standard. In previously proposed federal RPS legislation, the federal RPS would effectively establish a national “floor” for renewable energy development. In many cases, these proposals would allow states to go above and beyond the federal requirement or to tailor a local requirement towards specific locally-desired resources. In this instance, state credits might, by default, count towards the fulfillment of the federal RPS. However, states would be allowed the flexibility to go beyond the federal standard. This approach would seem to have merit and, with the approval of my sponsors at the Department of Energy, I would be happy to work with the Committee in considering this and other approaches.

Question 4. If a multi-tier approach like the Pennsylvania RPS model was to be used in a National Power Generation Diversity Standard, what kinds of resources should be included?

Answer. It seems to me that at least three standards should apply to decisions about resource inclusion. First, does the resource provide important public benefits to the United States that are not otherwise being recognized in electric supply decisions. Second, does the resource need additional policy assistance to achieve significant levels of deployment. Third, is inclusion in a portfolio standard the most effective means to support the resource in question. Of course, it is up to this Committee to determine what “public benefits” are sought under a diversity standard, and therefore what specific resources deserve support under this policy (or an alternative policy best suited to those resources). Under a multi-tiered diversity standard, it is also important that resources be appropriately separated from one another. For example, if there is unique interest in renewable energy generation, then a specific tier that only includes renewable generation would be warranted. Decisions on this score are ones of policy, not of analysis.

Question 5. Should there be different levels of credit for different classes of resources?

Answer. Several states have developed such “extra-credit-multipliers,” e.g., Arizona, Nevada, New Mexico, Washington D.C., Maryland, etc. Typically, such multipliers are intended to “level the playing field” among technologies that are at different stages of commercialization and cost. Ultimately, it is a policy decision as to whether the goal of the diversity standard is to require competition among all eligible resources (and to thereby minimize the cost of achieving the target), or to provide an extra incentive for certain preferred, higher-cost resources (ensuring more diversity within the target, but presumably coming at a higher cost). Of course, establishing different resource bands or multiple tiers can have a similar effect. Finally, I might also note that if states are allowed to go beyond the federal standard and apply their own preferences for certain resources, then it may be less necessary for a federal policy to develop such tiers or multipliers. With the approval of my sponsors at the Department of Energy, I would be happy to work with the Committee in considering the various options.

Question 6. What should the States’ roles be in determining what resources are assigned to what tiers and how much credit each should receive?

Answer. Presumably, a federal diversity standard would legislatively establish eligibility guidelines as well as tiers and/or multipliers. Though state bodies and others would have the ability to weigh-in in advance of the legislation, it is not evident to me that those same states would have a role in determining these rules *ex post*. That said, if states are offered the flexibility to exceed the federal standard, then they might develop their own rules for renewable purchases above the federal requirements, as highlighted in an answer to a previous question.

Question 7. Should improvements to transmission constraints and new storage facilities, like compressed wind facilities, also be credited under a National Power Generation Diversity Standard if they result in more efficient use of energy? Similarly, should demand-side management gains and other efficiency and conservation efforts be credited?

Answer. Whether such resources are included in a diversity standard is a matter of policy. Energy efficiency has been included in the Pennsylvania portfolio standard, and is also referenced in the portfolio standards established in Colorado and Hawaii. Dedicated energy efficiency portfolio standards are also underway in a limited fashion in Europe.

The key technical difficulties in including energy efficiency under a diversity standard come down to measurement and attribution: how to measure energy saving (i.e., it is easier to measure electricity generation than electricity savings, and it can be challenging to identify “incremental” savings beyond some baseline), and how to allocate those savings to obligated parties under a diversity standard (i.e., who initially owns the credits). These difficulties are surmountable, but will require serious effort. No U.S. state has yet to grapple with these specific difficulties, though there has been work done on this topic in Europe and Australia. I might recommend a further exploration of the nascent international experience with energy efficiency portfolio standards, and associated trading, to assess lessons learned (several nations are considering energy efficiency portfolio standards and initial implementation has begun in a subset of these countries—Italy, France, UK, Australia). I would also note that an International Energy Agency project involving five European countries is currently exploring the issues of energy efficiency portfolio standards and associated trading; the U.S. DOE is monitoring the progress of this effort.

Improvements in transmission efficiency may be considered a form of energy efficiency, and its inclusion (or not) in a diversity standard could be discussed in whatever regulatory proceedings would be necessary to define the rules for the participation of energy efficiency under a diversity standard. Similar measurement issues would arise here, as with more traditional forms of energy efficiency investments. Wind power would, presumably, qualify whether used in a compressed air application or not.

Question 8. Under a traditional RPS, a supplier might be obliged to purchase renewable credits from the Secretary of Energy to meet his obligation if he could not generate the requirement or if found that buying it cost more than buying a credit from the Secretary. What if instead of spending the money on purchasing credits from the Government, which does nothing to increase diversity, the supplier was credited with meeting that obligation through investments in developing new diverse resources that equal the amount of money he would have paid the Government? In other words, should a retail supplier be able to receive credit for investments in renewable or other eligible resources?

Answer. Federal RPS proposals have almost universally applied a "cost cap" in the form described above. States, however, have often used alternative approaches. In some cases, funds collected from the credit cost-cap are used by a state government entity to directly encourage renewable energy production (e.g., Massachusetts, Connecticut, Washington D.C., New Jersey, Pennsylvania, Rhode Island, and others). Such an approach ensures that funds are used to encourage diversity, but puts the state in charge of the use of such funds. In Arizona, meanwhile, electricity utilities are allowed to meet a small portion of their RPS by investing in renewable energy R&D.

The question here proposes a different approach: the ability of the retail electricity supplier to directly invest in renewable or other eligible resources using the amount of money that otherwise would have been spent on purchasing credits from the Department of Energy. This is a creative option, though its details would need to be further developed. For example, what kinds of investment would "count": only investment in renewable or diverse electricity supply, or also investments in research and development or manufacturing capability? If the latter, rules for how to define eligible and ineligible investments would be required. If the former, one would need to develop rules that would not allow a retail supplier to dedicate all of its diversity standard resources to an excessively costly generation source that would supply little electricity. Though the sentiment behind this approach is sound (ensuring that funds are truly used to encourage diversity), it is unclear whether workable mechanics could be developed. A variety of other approaches might also be considered and, with the approval of my sponsors at the Department of Energy, I would be happy to work with the Committee in considering the various options.

Question 9. If there was a National Power Generation Diversity Standard with requirements of up to 10% diverse resources, how important would tax credits still be to a project's finance-ability?

Answer. Federal tax incentives are—very clearly—currently critical to the expansion of renewable energy markets. Though much is said about the role that states currently play in encouraging renewable energy development, it is often forgotten just how important federal tax incentives have been. A review of the history of recent wind installations in the United States, which fluctuate wildly with the availability of the federal production tax credit, demonstrates this to be the case. It is also clear, however, that with the level of renewable energy deployment possible under a national portfolio standard, the cost of indefinitely continuing federal tax incentives would be substantial.

In theory, under a well-functioning national portfolio standard, federal tax incentives would no longer be necessary. Electricity suppliers would be required to purchase renewable energy credits, and thereby pay for any above-market cost of renewable electricity. However, one would also expect that a transition period would be needed between the current tax-incentive regime and a possible future, fully functional portfolio standard. This might call for a gradual phase-out of federal tax incentives as a national portfolio standard takes effect.

RESPONSES OF DR. WISER TO QUESTIONS FROM SENATOR TALENT

Question 1. If we mandate a national renewable portfolio standard, how would the transmission needed to get wind from remote locations, onshore or offshore, to load centers be paid for?

Answer. This question points out one of the important implementation issues for any policy that would greatly expand renewable energy deployment, whether implemented at the state or federal level. But, as has been acknowledged by many, lack

of transmission is a key issue that affects not only wind power, but also other energy resources that are often located remotely, such as coal and geothermal power. There is also widespread concern that lack of transmission may affect electric reliability in some regions of the country. Ultimately, new transmission will have to be built if reliability is to be preserved.

Building new transmission may allow access to remote but perhaps ultimately less expensive energy sources such as wind, geothermal, and coal. Several regions have undertaken studies not only to examine whether transmission expansion is necessary, but what the cost savings would be over time if lower cost but remote energy sources were able to be accessed. The Midwest ISO's 2003 transmission expansion plan, for example, determined that adding 10,000 MW of wind could be cost effective if transmission was expanded to accommodate it. More recently, the Rocky Mountain Area Transmission Study (RMATS), an ad hoc planning process encompassing Colorado, Idaho, Montana, Utah, and Wyoming, determined that three transmission expansion projects, at a cost of \$970 million, could deliver annual net savings of between \$61 million and \$531 million (by supporting 1880 MW of incremental wind and 2200 MW of incremental coal). The actual net savings will depend critically on natural gas prices and hydroelectric conditions. I would be happy to direct the Committee to these and other recent transmission studies.

Under present circumstances, additional transmission is paid for through a variety of means. Transmission cost recovery and allocation is often overseen by FERC, but is also affected by local public utility commissions, regional transmission organizations, and perhaps, regional collaboratives such as RMATS. The market benefits of adding new transmission to access remote energy resources may be significant enough that state regulators or, if applicable, regional institutions such as regional transmission organizations, may determine that ratepayers should finance the new transmission. Akin to interstate highways, major new transmission of this type (often providing reliability and economic benefits) will tend to be "socialized"—that is, paid for by ratepayers on a regional basis. In contrast, smaller transmission projects triggered by specific project developers will typically be paid for, at least initially, by the generation owner. In these instances, cost allocation may follow FERC policy of having the generator pay for transmission improvements up front, and then be reimbursed over time with transmission credits. Alternatively, FERC may allow regional transmission organizations to require generators to pay for transmission expansion as a condition of interconnection. The existence of a diversity standard may ease transmission financing, by providing longer-term contracts for eligible generators and by signaling policy direction. Nonetheless, lack of clarity on how transmission costs are to be allocated is clearly slowing transmission investment in our nation.

A promising development is the emergence of transmission infrastructure authorities. Wyoming was the first state to do this by creating the Wyoming Infrastructure Authority (WIA) to own, operate, and maintain high-voltage transmission facilities. A five-member board, appointed by the Governor, directs the WIA. The WIA can issue revenue bonds to raise capital to build transmission infrastructure that it will own, with no limit on bonding authority. These bonds would be exempt from state taxation and may reduce the cost of transmission projects as compared to private equity and debt financing. The bonds cannot be backed by the faith and credit of the State of Wyoming, meaning that the bonds must be secured by a revenue stream if the financial community is to support the bonds (as such, certainty of transmission cost allocation and payment is still required). At least three other states—New Mexico, North Dakota, and South Dakota—are also considering establishing transmission infrastructure authorities.

In summary, significant new wind expansion will necessitate transmission investments, and this expansion will have costs. Recent regional studies show that these costs are not insignificant, but neither do they eliminate the potential benefits of wind power. Of course, this is not an issue unique to wind, and the broader issue of expanding transmission to meet the nation's desire for low-cost, reliable power is an important one.

Question 2. How should nuclear energy and clean coal through coal gasification be factored into a national renewable portfolio standard?

Answer. Whether nuclear, coal gasification, or any other resource should be included in a national portfolio standard is question of policy that I am not prepared to address. As I noted in response to an earlier question, however, it seems to me that at least three standards should apply to decisions about resource inclusion. First, does the resource provide important public benefits to the United States that are not otherwise being recognized in electric supply decisions. Second, does the resource need additional policy assistance to achieve significant levels of deployment. Third, is inclusion in a portfolio standard the most effective means to support the

resource in question. It is up to this Committee to determine what “public benefits” are sought under a diversity standard, and therefore what specific resources deserve support under this policy (or an alternative policy best suited to those resources).

Only one state currently allows a broad range of so-called “traditional” energy sources into their portfolio standard: Pennsylvania. In that instance, waste coal, distributed generation, energy efficiency, large-scale hydropower, and coal gasification compete for a second tier of the state’s portfolio standard, a tier that grows to 10% by 2020. The more typical renewable energy sources compete within a separate tier, which rises to 8% by 2020. Other states have also created resource tiers (e.g., Arizona, Colorado, Connecticut, Washington D.C., Maryland, Minnesota, Nevada, New Jersey, New York, Rhode Island), but in these instances the tiers only reflect different renewable resource eligibility rules. Creating separate tiers of this type has the benefit of allowing resources to compete only within their specific tier (and thereby ensuring some diversity in results), but as the number of tiers increases so does the complexity of the policy for the regulator and for obligated electricity suppliers.

An alternative approach is to use credit multipliers. Several states have developed such “extra-credit-multipliers,” e.g., Arizona, Nevada, New Mexico, and others. Typically, such multipliers are intended to “level the playing field” among technologies that are at different stages of commercialization and cost, or to place a preference on certain resources. This approach might also be explored if additional energy sources were to be considered under a national diversity standard.

Question 3. We heard testimony from Mr. Brian O’Shaughnessy, CEO of Revere Copper Products, as to the potentially extraordinary cost of adding wind generation (additional transmission, three times the capacity requirements to meet the sales requirements, plus balancing and load following costs), particularly in areas of the country with low wind speeds. To what extent should the cost of adding renewable resources as compared to other resources, be factored in to any renewables requirement? Should economic dispatch of more efficient generating units also play a role?

Answer. I would first like to address the comment that wind power is enormously expensive. With the currently available federal tax incentives, my review of recent wind power sales agreements shows that utilities are purchasing wind power under long term contracts at prices that average -3 cents/kWh (real \$2003). There is considerable range around this average value, with the least costly projects selling power at -2 cents/kWh (real \$2003) and the higher cost projects selling at over 4 cents/kWh (real \$2003). This compares to the cost of new gas- or coal-fired generation that the Energy Information Administration projects to be -5 cents/kWh (real \$2003). Even without the federal production tax credit, wind generation costs—at the busbar—would be similar to those for new coal and natural gas at least in favorable wind resource areas.

It is true that wind power is a variable resource, and cannot be flexibly dispatched in the same way as gas-fired generation. The science of understanding the costs of this variability has grown considerably in recent years led, in part, by the U.S. Department of Energy and the National Renewable Energy Laboratory. Studies have been conducted by various utilities and consulting firms, by GE, and by the National Renewable Energy Laboratory. Study after study is finding that at even significant wind penetrations, the cost of managing wind’s variability is likely to be relatively modest, perhaps 0.2 to 0.5 cents/kWh. In large part this is because the variability of wind is found to not be correlated with the variability of demand for electricity. In addition, as wind forecasting has improved, the cost of managing variable wind generation has decreased. Newer studies are being designed and carried out to explore the impact of even higher levels of wind penetration.

Though one should not dismiss or ignore the real costs that wind imposes on the electrical system, it is also important to understand that other generation units also have their drawbacks. Older coal plants and nuclear plants, for example, generally ramp up and down very slowly and are designed to run flat out, meaning that these plants are not likely to be good candidates for load following or spinning reserves; hydropower and gas-fired plants, on the other hand, are quick to start up and are very good at providing spinning reserves. These characteristics and traits of each technology can balance each other out nicely.

As noted in response to an earlier question, the incremental cost of transmission may also be significant, as it is for certain other resources. However, in addressing all of these costs in a comprehensive fashion, a growing number of utilities are finding that wind power can be an important part of a low-cost, low-risk electricity supply portfolio. I would be happy to direct the Committee to relevant studies that cover the above points. There are, of course, real limits to the degree to which a supply portfolio can economically include wind power, and these limits are more significant in areas with less attractive wind resources. However, on a national basis,

many recent studies are finding that wind power can be an attractive option, even at significant levels of penetration.

Finally, in considering a federal diversity standard, a careful accounting of all of the possible costs and benefits of wind power, and other eligible energy sources, would be desirable. In that regard, I would simply note that the DOE's Energy Information Administration has, in the past, evaluated the potential cost-impacts of federal RPS proposals. Though there are always limits to energy models and the results derived from such models, the Committee might chose to avail itself of the EIA's services in evaluating different possible diversity standards.

Question 4. Would it be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet load growth?

Answer. This approach has not been used in any U.S. state, or in any other country that has developed a renewables portfolio standard (UK, Italy, Belgium, Australia, Japan, Sweden). That is not to say that the idea is without merit, and I do see some advantages to this approach. The key difficulty, in my view, comes in those states that have moved or are moving towards retail electricity competition. In these states, individual electricity suppliers experience substantial changes in load growth from one year to the next (as load switches to a different competitive supplier). Application of a standard to "incremental" load may be challenging in this instance because for any single supplier load could increase from one year to the next, only to then decrease the following year, and then increase again the next year. Applying a portfolio standard in this instance may be an administrative challenge, and would certainly require additional thought. It perhaps should also be noted that applying a standard to load growth ensures that the standard cannot increase annually by more than the underlying growth in load, which may limit the impact of a standard especially if the standard includes non-renewable sources such as coal gasification and nuclear power.

RESPONSES OF MR. MORGAN TO QUESTIONS FROM SENATOR DOMENICI

Question 1. Do current Federal policies constrain State RPS programs?

Are there instances where utilities have examined opportunities to improve their efficiency or include technologies as part of an overall energy portfolio only to find themselves constrained by federal policies? If so, how might we change those policies to offer utilities more flexibility?

Answer. I am not aware of any such instances.

Question 2. Are State RPS programs successful?

Many States have mandated that utilities draw a specific percentage of their generation from renewable energy according to a firm schedule. How are these State programs working?

Answer. Among the 19 jurisdictions that have adopted some form of renewables portfolio standard, these policies are in various stages of implementation. Some States like Texas, Maine, and Arizona have a few years of experience with RPS. Others like Colorado, Maryland, Pennsylvania, and my own District of Columbia are still in the early stages of implementation. The viability of RPS as a policy for encouraging diversity in energy supplies is attested to by its growing popularity at the State level. Many RPS design and implementation issues are addressed in NARUC's report "The Renewables Portfolio Standard—A Practical Guide" which I quoted in my oral statement. I have attached excerpts from the NARUC report (Executive Summary and Chapter One). The report can be downloaded from NARUC's website: www.naruc.org.

Question 3. Should some suppliers be exempt from a Federal RPS?

If a federal RPS mandate is imposed, do you believe that it should apply to all electricity suppliers? If not, wouldn't exemptions skew the electricity market by favoring some suppliers over others?

Answer. Yes, any RPS should be applicable to all retail electricity suppliers without exception. Otherwise, consumers will have an artificial incentive to switch suppliers, and the result would be economically inefficient.

Question 4. How should utilities be allowed to recover costs for transmission for intermittent sources?

The intermittent nature of wind generation makes it difficult to upgrade transmission lines solely to handle new wind generation capacity because the increased capacity is likely to be un-used 60-70 percent of the time. How should regulators treat cost recovery for utilities that expand transmission capacity to carry intermittent alternative resources like wind generation?

Answer. All State regulatory commissions have established procedures for cost recovery of new or upgraded transmission facilities, and I see no reason why upgrad-

ing transmission facilities for wind should require any special regulatory treatment. Furthermore, wind-generated power typically shares transmission facilities with power generated by other resources, and it generally displaces power from fossil fuels that otherwise would have required transmission capacity for delivery.

Question 5. Will “build it in-State” requirements hinder a Federal RPS?

Some State RPS programs require suppliers to derive the renewable power from facilities in that State. If a National Power Generation Diversity Standard was to be developed, how should such State requirements be dealt with? Are these “build it in-State” requirements violations of the commerce clause?

Answer. I personally do not support a “build it in State” requirement, which I believe defeats one of the purposes of an RPS. One advantage of an RPS is its flexible, market-based approach which takes advantage of resource diversity among the States, thereby minimizing costs. However, because “build it in State” provisions are not widespread in State RPS requirements, I am not convinced that a federal legislative fix is needed. I have no opinion regarding whether or not such requirements violate the “Commerce Clause”.

Question 6. Should the Federal Government impose utility efficiency performance requirements?

Some have suggested that utilities should be encouraged to adopt energy efficiency performance standards or that such standards be imposed on public utilities as part of an overall energy portfolio.

How would your organization react to a national efficiency performance standard for public utilities?

Answer. End-use energy efficiency should be encouraged by federal and State policy, but not necessarily through performance standards. Because energy efficiency cannot be directly measured in the same sense as renewable generation, it is difficult to establish criteria for documentation of energy savings. Any energy efficiency performance standard would need explicit criteria for measurement and verification. If an energy efficiency performance standard were to be pursued, I would recommend it as an option, not a requirement. That is the approach taken by Pennsylvania in its new Alternative Energy Portfolio Standard, and many observers are anxious to see how well it works.

Question 7. Can State programs be harmonized with a Federal RPS?

Close to 20 States have adopted renewable resource goals or renewable “must offer” programs. These programs differ in a number of ways such as:

- what qualifies as an eligible renewable resource;
- whether the resources must be developed within the region;
- what the compliance dates are;
- whether tradable certificates can be bought and sold;
- what baselines are set;
- how existing resources are treated; and
- whether alternative compliance payments can be made in lieu of procuring the required amount of renewables.

Do you believe that it is possible to harmonize a federal RPS mandate with these existing State programs? If so, how?

Answer. Yes, a federal RPS can be harmonized with existing RPS requirements at the State level, without preempting State RPS requirements. In most cases, the majority of energy resources that comply with a State RPS could comply with the federal RPS at the same time. The fact that some States might include additional resource types or set a higher percentage threshold would not necessarily interfere with the federal RPS. Furthermore, the existence of RPS requirements in a number of States would make the goals of a federal RPS easier and cheaper to achieve.

HOW TO IMPROVE THE TRADITIONAL RPS

As you know, there are efforts underway to craft a new kind of RPS that goes beyond the limited boundaries of a few favored traditional renewables and answers the need to increase of fuel diversity for power generation needs. There are many who favor allowing States to proceed to develop their own resource plans without federal interference, but there is also support for a nationalized program.

The following questions explore new approaches to promoting Generation Diversity Standards.

Question 8. In setting target levels for diverse generation resources, one proposal is to place any new resource obligation on new load growth—the “incremental basis” approach.” The main benefit of this approach is that it allows the supplier and market to adjust as generation demand increases. Do you support this approach and why?

Answer. This approach of applying a portfolio obligation to incremental resources seems workable, provided the required percentage is adjusted upward accordingly.

Question 9. If there was a National Power Generation Diversity Standard, should credits offered under a State program also count towards fulfillment of any federal obligations?

Answer. Yes, to the extent that the same types of resources are eligible for both standards.

Question 10. If a multi-tier approach like the Pennsylvania RPS model was to be used in a National Power Generation Diversity Standard, what kinds of resources should be included?

Answer. I recommend applying the standard to renewable resources including solar, wind, geothermal, and biomass, as with the majority of State RPS requirements. These resources offer the greatest benefits in terms of fuel diversity and reduced environmental impacts. I do not recommend including baseload technologies such as emerging nuclear technologies and coal gasification, which would not enhance the nation's fuel diversity. Because these technologies come in large size increments and are not yet commercially available, they would likely add substantial complications to an RPS. These technologies, are better suited for other public policy tools such as RD&D and loan guarantees.

Question 11. Should there be different levels of credit for different classes of resources?

Answer. In general I prefer the simplicity and flexibility of a single standard. However, a case can be made for a separate standard for solar because of its particular benefit and cost characteristics.

Question 12. What should the States' roles be in determining what resources are assigned to what tiers and how much credit each should receive?

Answer. The States' role should apply to the State's RPS requirements, if any, not to a federal RPS.

Question 13. Should improvements to transmission constraints and new storage facilities, like compressed wind facilities, also be credited under a National Power Generation Diversity Standard if they result in more efficient use of energy? Similarly, should demand-side management gains and other efficiency and conservation efforts be credited?

Answer. Electricity storage facilities may offer important capacity benefits. However, energy storage generally entails substantial losses of energy and cannot be considered an efficiency device. While it may be possible for an RPS to provide credit for efficiency and conservation efforts, this raises some challenging issues. Because energy efficiency cannot be directly measured in the same sense as renewable generation, it would be necessary to establish complex criteria for documentation of energy savings. Any energy efficiency performance standard would need explicit criteria for measurement and verification.

Question 14. Under a traditional RPS, a supplier might be obliged to purchase renewable credits from the Secretary of Energy to meet his obligation if he could not generate the requirement or if found that buying it cost more than buying a credit from the Secretary.

What if instead of spending the money on purchasing credits from the Government, which does nothing to increase diversity, the supplier was credited with meeting that obligation through investments in developing new diverse resources that equal the amount of money he would have paid the Government? In other words, should a retail supplier be able to receive credit for investments in renewable or other eligible resources?

Answer. I would not recommend this approach which would be difficult to enforce and would invite gaming and perverse behavior by energy suppliers. If suppliers are able to choose their own compliance options, there is no assurance that public goals would be achieved beyond a "business as usual" approach.

Question 15. If there was a National Power Generation Diversity Standard with requirements of up to 10% diverse resources, how important would tax credits still be to a project's finance-ability?

Answer. A well designed diversity standard that requires a minimum level of renewable generation might over time obviate the need for existing tax credits for renewable generation. A diversity standard that includes baseload technologies as well as renewables is less likely to achieve that goal.

RESPONSES OF MR. MORGAN TO QUESTIONS FROM SENATOR TALENT

Question 1. If we mandate a national renewable portfolio standard, how would the transmission needed to get wind from remote locations, onshore or offshore, to load centers be paid for?

Answer. This is a matter that should properly be determined by utility regulators in the State where the transmission facilities are located. Utility regulators are accustomed to addressing cost implications of new generation and transmission facilities.

Question 2. How should nuclear energy and clean coal through coal gasification be factored into a national renewable portfolio standard?

Answer. I believe the need for incentives for new baseload generation technologies can be better addressed through other policy options such as loan guarantees and RD&D. At this time, emerging nuclear and coal gasification technologies probably have not advanced commercially to the point where they can benefit from an RPS, and they would not enhance the nation's fuel diversity. Furthermore, RPS is better suited for smaller generation increments than for the large baseload facilities represented by nuclear and clean coal facilities. Inclusion of large baseload facilities would necessitate raising the percentage obligation for each company's portfolio. If a portfolio standard becomes too large and too inclusive, it begins to resemble a federal mandate for resource acquisition rather than a market-based incentive for fuel diversity. I believe a portfolio standard that is too inclusive would needlessly constrain future investment in power facilities to the detriment of consumers.

Question 3. We heard testimony from Mr. Brian O'Shaughnessy, CEO of Revere Copper Products, as to the potentially extraordinary cost of adding wind generation (additional transmission, three times the capacity requirements to meet the sales requirements, plus balancing and load following costs), particularly in areas of the country with low wind speeds. To what extent should the cost of adding renewable resources as compared to other resources, be factored in to any renewables requirement? Should economic dispatch of more efficient generating units also play a role?

Answer. The market-based features of an RPS will ensure that incremental transmission costs are properly taken into account in selecting new generation resources and that facilities are located where they are most cost effective.

System operators such as regional transmission organizations (RTOs) can assure that generating facilities are optimally dispatched. The option for energy suppliers to purchase credits at a fixed price from the government limits the cost of new renewables facilities.

Question 4. Would it be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet load growth?

Answer. Applying an RPS to incremental load growth may be a viable approach worth considering. The percentage requirement would need to be adjusted upward accordingly.

RESPONSES OF MR. BRUNETTI TO QUESTIONS FROM SENATOR DOMENICI

Question 1. Should some suppliers be exempt from a Federal RPS?

If a federal RPS mandate is imposed, do you believe that it should apply to all electricity suppliers? If not, wouldn't exemptions skew the electricity market by favoring some suppliers over others?

Answer. All electricity suppliers should be included. Exempting some suppliers, such as electric cooperatives or municipal providers, for example, would indeed significantly skew the market.

Question 2. Would a Federal credit and trading program create a double subsidy?

Many of the eligible resources under most RPS programs also qualify for the federal production tax credit, which is equal to approximately 1.8 cents per kWh. If we were to adopt a federal RPS with a 1.5 cent per kWh cost cap, dually eligible renewable resources could receive over 3 cents per kWh of subsidies. This is roughly the cost of generating electricity from coal or nuclear plants in many parts of the country. How can this double subsidy be justified and does it best serve consumers?

Answer. We believe that a production tax credit could be phased out consistent with the timing of a federal RPS "phase-in." This would provide a certain continuity in support for renewable energy development and help smooth the transition to the RPS. Again, this answer assumes that these programs would apply to all suppliers.

HOW TO IMPROVE THE TRADITIONAL RPS

As you know, there are efforts underway to craft a new kind of RPS that goes beyond the limited boundaries of a few favored traditional renewables and answers the need to increase of fuel diversity for power generation needs. There are many who favor allowing States to proceed to develop their own resource plans without federal interference, but there is also support for a nationalized program.

The following questions explore new approaches to promoting Generation Diversity Standards.

Question 3. In setting target levels for diverse generation resources, one proposal is to place any new resource obligation on new load growth—the “incremental basis” approach. The main benefit of this approach is that it allows the supplier and market to adjust as generation demand increases. Do you support this approach and why?

Answer. We would generally not support this approach, both from a practical standpoint and from a fairness perspective. Load growth varies over time, from area to area, and from utility to utility. Serving load growth also involves a mix of both regulated and unregulated electricity suppliers. It is also very difficult to distinguish between horizontal growth (use per customer) and vertical growth (additional use by existing customers). The ability of a utility to project growth precisely and to apply a renewable requirement only to that portion of demand would be complex and exceedingly difficult under these circumstances, and we would be concerned about the cost recovery risk for a regulated utility trying to meet the standard. Equally important, we believe such an approach would penalize rather than reward utilities that have been aggressively pursuing renewable energy development already.

Question 4. If there was a National Power Generation Diversity Standard, should credits offered under a State program also count towards fulfillment of any federal obligations?

Answer. Yes, to the extent the type of generation included under the state program is consistent with the generation included in the federal program, since these credits represent actual generation of the energy that is desired. To do otherwise, would create unnecessary complexity under this type of program. The Federal legislation could provide some broad parameters under which the state could issue the credits to allow flexibility and recognize differences but still provide some standardization of the market.

Question 5. If a multi-tier approach like the Pennsylvania RPS model was to be used in a National Power Generation Diversity Standard, what kinds of resources should be included?

Answer. Generally, non-emitting resource options should be included in this type of standard e.g. wind, solar, conservation.

Question 6. Should there be different levels of credit for different classes of resources?

Answer. In concept we would support different levels of credit, recognizing that the cost of entry and environmental benefits vary from one form of energy to another. However, more policy analysis is probably warranted to ensure that any system implemented is simple to administer and does not unduly reward or penalize one class or type of resource over another.

Question 7. What should the States’ roles be in determining what resources are assigned to what tiers and how much credit each should receive?

Answer. In our view, assuming establishment of a National Power Generation Diversity Standard, states would participate in a national rulemaking process undertaken to implement the federal legislation. In this rulemaking the individual interests of the states would be recognized and given significant deference in the development of the national policy.

Question 8. Should improvements to transmission constraints and new storage facilities, like compressed wind facilities, also be credited under a National Power Generation Diversity Standard if they result in more efficient use of energy? Similarly, should demand-side management gains and other efficiency and conservation efforts be credited?

Answer. Assuming passage of a National Power Generation Diversity Standard, we would support this approach for energy transmission and storage. Clearly, both of these components are becoming more and more critical to our electrical system’s capability to accommodate additional renewable energy in a cost-effective manner. Some amount of credit should probably be given to transmission improvements and new energy storage, at least initially to facilitate entry on the part of renewable energy resources. In the longer term, it is likely that investments in these facilities would be captured in the value of a renewable energy (or generation diversity) credit. Credit for DSM, conservation, and efficiency is a yet more difficult matter. While we also support this concept, we recognize there is a vast array of governmental programs encouraging these kinds of measures, and implementing a credit program with corresponding tracking and accounting will require additional analysis and consideration.

Question 9. Under a traditional RPS, a supplier might be obliged to purchase renewable credits from the Secretary of Energy to meet his obligation if he could not generate the requirement or if found that buying it cost more than buying a credit from the Secretary.

What if instead of spending the money on purchasing credits from the Government, which does nothing to increase diversity, the supplier was credited with meeting that obligation through investments in developing new diverse resources that equal the amount of money he would have paid the Government? In other words, should a retail supplier be able to receive credit for investments in renewable or other eligible resources?

Answer. We believe this idea has merit and is likely preferable to involving the Department of Energy in the credit market.

Question 10. If there was a National Power Generation Diversity Standard with requirements of up to 10% diverse resources, how important would tax credits still be to a project's finance-ability?

Answer. We feel that tax credits would remain important initially but could gradually be phased out as requirement levels associated with a new standard become effective.

RESPONSES OF MR. BRUNETTI TO QUESTIONS FROM SENATOR TALENT

Question 1. If we mandate a national renewable portfolio standard, how would the transmission needed to get wind from remote locations, onshore or offshore, to load centers be paid for?

Answer. Provision of transmission would appear to depend on the circumstances (e.g. state versus interstate transmission requirements). Certainly, sufficient new transmission capacity would be needed to support expansion of renewable energy resources. The FERC is considering RTO pricing and participant funding rules that could dictate how transmission funding needs are accommodated, depending on the situation.

Question 2. How should nuclear energy and clean coal through coal gasification be factored into a national renewable portfolio standard?

Answer. We believe these forms of energy should be included in a generation diversity standard, but may not necessarily be appropriate for a renewable energy standard, depending on the policy Congress wishes to establish.

Question 3. We heard testimony from Mr. Brian O'Shaughnessy, CEO of Revere Copper Products, as to the potentially extraordinary cost of adding wind generation (additional transmission, three times the capacity requirements to meet the sales requirements, plus balancing and load following costs), particularly in areas of the country with low wind speeds. To what extent should the cost of adding renewable resources as compared to other resources, be factored in to any renewables requirement? Should economic dispatch of more efficient generating units also play a role?

Answer. It is our view that there are ancillary costs associated with incorporating additional renewable energy into our nation's energy grid and that these costs need to be taken into account. We would expect such costs to be reflected and imbedded in the value of renewable energy credits, and establishing a cost cap may be one effective way to help ensure that the cost of the renewable energy (and corresponding credits) remain within reasonable economic parameters. A well-designed, market-based credit system should also encourage development and utilization of more efficient generating units.

Question 4. Would it be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet load growth?

Answer. We would generally not support this approach, both from a practical standpoint and from a fairness perspective. Load growth varies over time, from area to area, and from utility to utility. Serving load growth also involves a mix of both regulated and unregulated electricity suppliers. The ability of a utility to project growth precisely and to apply a renewable requirement only to that portion of demand would be complex and exceedingly difficult under these circumstances, and we would be concerned about the cost recovery risk for a regulated utility trying to meet the standard. Equally important, we believe such an approach would penalize rather than reward utilities that have been aggressively pursuing renewable energy development already.

RESPONSE OF WAYNE BRUNETTI TO QUESTION FROM SENATOR BUNNING

Question 1. Mr. Brunetti, Kentucky does not have many sources of renewable energy. It would be very difficult to put a wind turbine or solar panels in the state and obtain sufficient amounts of energy from them. Since many states are in the same boat as Kentucky, how would a national RPS affect ratepayers in states with low amounts of renewable energy? What would a company in a low renewable state have to do in order to comply with a national RPS as the one suggested in last Congress' energy bill?

Answer. These issues would seem to emphasize the importance of a well-designed national renewable energy credit trading program. We feel that Congress would want to establish the most effective goals for the nation as a whole, and then look to the marketplace to achieve these goals most efficiently. Depending on the nature and intent of the standard enacted, e.g. a Diversity Generation Standard, conservation and efficiency programs implemented in a state could also be included in the achievement of the national goal. These are objectives to which Kentucky could contribute.

RESPONSES OF MR. BRUNETTI TO QUESTIONS FROM SENATOR SALAZAR

COLORADO AMENDMENT 37 PROVISIONS

Question 1. Xcel Energy has acknowledged that its customers supported Colorado's Amendment 37, which requires a 10% renewable portfolio by 2015, by a significant margin in the November election, and your company has stated its willingness to work cooperatively to implement this new law. Will you do everything you can to achieve the goals of Amendment 37 in Colorado, and especially the solar energy component of this law? Will Xcel Energy agree not to delay the solar implementation schedule in Colorado's Amendment 37?

Answer. With due consideration of the rate impact cap established in Amendment 37, the company will work hard and cooperatively to achieve the targets set by the new law. Xcel Energy has aggressively pursued development of renewable resources in the past and will continue to do so in the future. We are now engaged in the rule-making process, which is important to ensuring that the measures we initiate to meet the solar and other new portfolio standards are also consistent with the Colorado PUC's requirements implemented to protect the interests of company's customers.

REDUCING GREENHOUSE GAS EMISSIONS

Question 2. In August of last year, Mr. Brunetti, you were quoted in a Business Week cover article on global warming. Speaking about cutting greenhouse gas emissions, you said:

"Give us a date, tell us how much we need to cut, give us the flexibility to meet the goals, and we'll get it done."

I appreciate your willingness to embrace greenhouse gas reductions and your recognition of the very real problem of global warming.

1) I would very much appreciate your input into how these reductions can best be achieved. What would your strategies be for making the cuts, and how can the government help you implement them?

2) How would your actions to reduce carbon emissions affect the diversity of your power supply?

Answer. We believe that the best means to achieve greenhouse gas (GHG) reductions will vary from company to company, and thus pursuing a voluntary approach to achieving those reductions is the preferable policy. Xcel Energy has been extremely pro-active in managing its GHG emissions for over a decade. The company was a charter member of DOE's Climate Challenge Program in 1993 and is now participating in the new GHG reduction agreement signed between DOE and the Edison Electric Institute just this last December. Acting on its own initiative, Xcel Energy announced voluntary corporate GHG targets and a Carbon Management Plan in April, 2004. This Plan includes objectives addressing both emissions intensity and total CO₂ emissions. In the case of emissions intensity, the target is to reduce the emissions rate from our overall energy supply portfolio by 7 percent by the year 2012. In terms of total emissions, our goal is to reduce the volume of our CO₂ emissions by 12 million tons through 2009. The company will be reporting progress toward these targets publicly beginning this Spring.

To date, the company has been able to obtain the majority of its reductions through energy conservation programs, lower-emitting generating facilities, efficiency improvements, and renewable energy. For example, Xcel Energy is the nation's second-largest retail provider of wind energy, with 884 MW in the current supply portfolio and plans to expand to over 2500 MW by 2012. The company has so far been able to achieve reductions cost-effectively without increasing costs to its customers. However, we expect this advantageous situation to become harder to maintain over time, as each incremental amount of reduction becomes more difficult and potentially more expensive. Looking ahead, therefore, we believe it is important to promote market-based approaches, greater planning certainty, and newer, cleaner technologies. We believe the government could do more to support development and deployment of integrated gasification combined cycle (IGCC) technology through R

& D funding and IGCC project tax incentives. We also feel it is vital to the nation's environmental interests for the federal government to ensure the continued operation of the country's nuclear power plant fleet and to respect its obligation to provide a repository for spent nuclear fuel.

RESPONSES OF MR. BOWERS TO QUESTIONS FROM SENATOR DOMENICI

Question 1. How would a Federal RPS affect consumer prices in areas with little opportunity to generate from renewables?

Mr. Bowers, you make it fairly clear in your testimony that the Southern Company believes the amount of electricity Southern can generate from traditional renewables—like solar, wind, and biomass—is significantly constrained. You argue that the imposition of a national RPS with a credit and trading system would generally require your company to purchase credits to meet its requirements. What would the impact of such a policy be on consumers in your service territory?

Answer. While Southern Company supports the use of cost-effective renewable energy, we do not support mandated standards or mandated credit trading. If forced to purchase credits, the impact on our consumers will depend on the amount we are required to purchase, the availability and cost of the credits.

For example, we would address a mandated 10% national RPS using our traditional “least-cost planning” approach. Depending on the cost and availability of credits, we would likely first deploy the limited amount of renewable generation that we have available in the Southeast (please refer to my previous written testimony). We believe that this would add less than 500 MW of new generation to our 39,000 MW system—far less than needed to meet a 10% mandate.

Southern would then be required to purchase credits in the amount of 80 to 90% of the total 10% requirement to meet the remaining portion of the mandate. If the credits were purchased from the DOE, we estimate that this would cost us an additional \$1.1 to \$2.3 billion by 2020. These costs would increase prices to Southern's customers, but add zero incremental generation resources as a benefit for customers.

Question 2. Does a traditional RPS—limited to solar, wind and biomass—impose excessive costs on utilities and their customers?

According to the Electric Power Research Institute, impacts of RPSs can be significant, especially for those companies that depend on coal and other fossil fuels to supply the power delivered to their customers. For example, under a 10% renewable portfolio standard, a large utility with 20,000 megawatts of generation delivering 140,000 gigawatt hours per year of power to customers would need to replace up to 14,000 gigawatt hours per year with renewable energy. If wind was the only economical choice, it would be necessary to build and operate or purchase power from 5000 to 7000 megawatts of wind generation, depending on the wind resource strength. Thus, a single utility's wind energy requirement would approximately double the installed wind capacity in the United States today. This example could also require an investment of about \$5 to \$7 billion in wind facilities; and an additional investment in transmission and control facilities, which would be required to integrate the intermittent wind generation into the grid. Other significant issues include public acceptance, land use, and noise, visual, and avian impacts.

Do you think EPRI's example accurately describes what could happen under a limited traditional RPS?

Answer. Yes. EPRI's analysis and approach is reasonable. The case for Southern Company is very nearly the same—only the numerical values are larger. Southern operates 39,000 MW of generation (a mix of coal, nuclear, natural gas and hydro). Our annual sales at Retail level (i.e. not including wholesale generation sold to other retail electricity providers) in 2004 were approximately 150,000 gigawatt-hours. We forecast continued growth in Retail sales. By 2020, we anticipate we would need 22,000 gigawatt-hours of renewable credits to meet a 10% RPS. The low-wind speeds in the Southeast limit the amount of generation achieved by any wind turbine. We estimate no more than 25% of the possible generation of a wind turbine could be achieved on an annual basis in the Southeast—compared to capacity factors in Texas and the Mid-West of 35 to 40%. Moreover, the 25% capacity factor in the Southeast could only be achieved by installations on mountain ridge tops—as evidenced by the Tennessee Valley Authority's 29 MW wind farm on Buffalo Mountain, Tennessee.

Assuming Southern built wind turbines with 25% capacity factors, to generate 22,000 gigawatt-hours with wind energy would require Southern Company to install 9,900 MW of wind turbines—over 5,500 individual 1.8 MW machines. At an installed capital cost of \$1250/kW, this would represent a significant capital require-

ment of over \$12 billion, not counting transmission investment. We consider this an excessive cost imposition on retail consumers in the SE.

It should also be noted that wind generation adds very little generation capacity to meet system peak demands. Southern is a summer peaking utility and wind generation is likely to be non-existent in the summer months. Thus, in the above example, while Southern would be installing \$12 billion in new wind generation, there would be little to no benefit for meeting peak loads. Southern would need to make incremental investments in dispatchable, peaking generation that would be needed under future load growth forecasts over and above wind generation investments. Thus, wind generation adds incremental capital costs that will not off-set peaking generation.

The issue of public acceptance and land use is very much of concern. To install 5,500 new wind turbines on mountain ridge tops would require an enormous amount of land. As noted in my original written testimony—and as pointed out by Senator Alexander in the March 8, 2005 hearing, mountain vistas in the Southeast are enjoyed by a large portion of the public for recreational purposes. We think the likelihood of gaining public acceptance of 5,500 wind turbines located on mountain ridge tops in the Southeast is zero.

HOW TO IMPROVE THE TRADITIONAL RPS

As you know, there are efforts underway to craft a new kind of RPS that goes beyond the limited boundaries of a few favored traditional renewables and answers the need to increase of fuel diversity for power generation needs. There are many who favor allowing States to proceed to develop their own resource plans without federal interference, but there is also support for a nationalized program.

The following questions explore new approaches to promoting Generation Diversity Standards.

Question 3. In setting target levels for diverse generation resources, one proposal is to place any new resource obligation on new load growth—the “incremental basis” approach. The main benefit of this approach is that it allows the supplier and market to adjust as generation demand increases. Do you support this approach and why?

Question 4. If there was a National Power Generation Diversity Standard, should credits offered under a State program also count towards fulfillment of any federal obligations?

Question 5. If a multi-tier approach like the Pennsylvania RPS model was to be used in a National Power Generation Diversity Standard, what kinds of resources should be included?

Question 6. Should there be different levels of credit for different classes of resources?

Question 7. What should the States’ roles be in determining what resources are assigned to what tiers and how much credit each should receive?

Question 8. Should improvements to transmission constraints and new storage facilities, like compressed wind facilities, also be credited under a National Power Generation Diversity Standard if they result in more efficient use of energy? Similarly, should demand-side management gains and other efficiency and conservation efforts be credited?

Answer. We choose to answer these questions as a group, since they deal with a proposed National Generation Diversity Standard. We believe that power generators should be allowed to responsibly select generation resources based on prudent decision criteria consistent with regional resource availability, environmental responsibility, local regulatory oversight and lowest costs.

At Southern Company, we continuously evaluate our generating mix in order to balance fuel risk and generation technology risk in an environmentally responsible manner to achieve the lowest overall cost to our consumers. In some of the states where we operate, some of our regulated affiliate companies do this review under State regulatory oversight through an Integrated Resource Planning (IRP) process. In other states where we operate without a State-regulated IRP process, we continuously evaluate our resource mix. We maintain a diverse generation mix today, with coal, nuclear, gas and hydro all playing important roles. We are aggressively pursuing Integrated Gasification Combined Cycle technology. We are performing R&D on biomass gasification technology. We are pursuing a diverse generation portfolio consistent with prudent operations, environmental responsibility and lowest cost.

Investments in transmission and/or energy storage should be considered as part of the overall cost of adding any generation resources and included in the cost analysis described above.

Demand side management gains and other efficiency and conservation programs should be considered only to the extent that they can be shown to be cost-effective means to impact future generation supply without causing cost increases for portions of our customer base.

Question 9. Under a traditional RPS, a supplier might be obliged to purchase renewable credits from the Secretary of Energy to meet his obligation if he could not generate the requirement or if found that buying it cost more than buying a credit from the Secretary.

What if instead of spending the money on purchasing credits from the Government, which does nothing to increase diversity, the supplier was credited with meeting that obligation through investments in developing new diverse resources that equal the amount of money he would have paid the Government? In other words, should a retail supplier be able to receive credit for investments in renewable or other eligible resources?

Answer. Again, we do not support the mandated purchase of credits or mandated investment in the development of specific generation resources. Investment in generation resources should be based on technology review, risk analysis and probability of achieving commercially viable, cost-effective generation that does not increase costs to consumers.

Question 10. If there was a National Power Generation Diversity Standard with requirements of up to 10% diverse resources, how important would tax credits still be to a project's finance-ability?

Answer. This question seems to pre-suppose that cost-effective renewable resources are available to take advantage of tax credits. Tax credits are likely to be important to the degree any emerging technology is immature or not cost-effective compared to traditional generation. If tax credits are used to incentivize market adoption of new technologies, the credits should apply to multiple generation resources, including wind, solar, all forms of biomass gasification, Integrated Gasification Combined Cycle (using coal), advanced nuclear, etc.

RESPONSES OF MR. BOWERS TO QUESTIONS FROM SENATOR TALENT

Question 1. If we mandate a national renewable portfolio standard, how would the transmission needed to get wind from remote locations, onshore or offshore, to load centers be paid for?

Answer. Additional transmission facilities required by wind generators and not otherwise needed by the local utility being asked to build the facilities should be paid for by the wind generators or their customers.

Question 2. How should nuclear energy and clean coal through coal gasification be factored into a national renewable portfolio standard?

Answer. We do not believe that there should be a mandated national renewable portfolio standard. We believe that the addition of generation technologies to a utilities' generation mix should be based the cost-effectiveness of the technology, regional resource availability, environmental responsibility and suitability to manage risk in an overall generation portfolio in such a way that minimizes costs to consumers while assuring adequate energy supply.

Question 3. We heard testimony from Mr. Brian O'Shaughnessy, CEO of Revere Copper Products, as to the potentially extraordinary cost of adding wind generation (additional transmission, three times the capacity requirements to meet the sales requirements, plus balancing and load following costs), particularly in areas of the country with low wind speeds. To what extent should the cost of adding renewable resources, as compared to other resources, be factored in to any renewables requirement? Should economic dispatch of more efficient generating units also play a role?

Answer. We are very concerned that the costs of renewable resources should be considered when making decisions about generation portfolio mix. Renewable resources should not be mandated irrespective of cost.

Question 4. Would it be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet load growth?

Answer. Incremental generation should be added to meet load growth on the basis of an evaluation of cost-effectiveness, environmental responsibility and suitability to meet load growth demands.

[Responses to the following questions submitted to the Department of Energy were not received at the time this hearing went to press.]

QUESTIONS FROM SENATOR DOMENICI

Question 1. Would a Federal credit and trading program create a double subsidy?

Many of the eligible resources under most RPS programs also qualify for the federal production tax credit, which is equal to approximately 1.8 cents per kWh. If we were to adopt a federal RPS with a 1.5 cent per kWh cost cap, dually eligible renewable resources could receive over 3 cents per kWh of subsidies. This is roughly the cost of generating electricity from coal or nuclear plants in many parts of the country. How can this double subsidy be justified and does it best serve consumers?

Question 2. Will expanded use of intermittent sources harm system reliability?

Will reliability suffer as a result of increasing reliance on generation sources like wind and solar that are intermittent, meaning they may not be available when needed? Will additional natural gas peaking capacity have to be added to deal with this problem?

Question 3. Does impending U.S. reliance on imported LNG have a beneficial effect on renewables, nuclear and domestic coal?

Recently, Cambridge Energy Research Associates' Senior Director of North American Power Larry Makovich said that future LNG supplies in North America are critical in all scenarios for future electric power generation. CERA estimates that power sector needs will cause natural gas market demand to expand between 14% and 36% by 2020. CERA predicts an increased risk of higher costs, on-going uncertainty surrounding natural gas supply, a drive to bring new sources of gas supply to market and an opportunity for other power generation fuels and technologies—especially coal, renewables and even nuclear—to grow. Do you agree with this analysis?

HOW TO IMPROVE THE TRADITIONAL RPS

As you know, there are efforts underway to craft a new kind of RPS that goes beyond the limited boundaries of a few favored traditional renewables and answers the need to increase of fuel diversity for power generation needs. There are many who favor allowing States to proceed to develop their own resource plans without federal interference, but there is also support for a nationalized program.

The following questions explore new approaches to promoting Generation Diversity Standards.

Question 4. In setting target levels for diverse generation resources, one proposal is to place any new resource obligation on new load growth—the “incremental basis” approach. The main benefit of this approach is that it allows the supplier and market to adjust as generation demand increases. Do you support this approach and why?

Question 5. If there was a National Power Generation Diversity Standard, should credits offered under a State program also count towards fulfillment of any federal obligations?

Question 6. If a multi-tier approach like the Pennsylvania RPS model was to be used in a National Power Generation Diversity Standard, what kinds of resources should be included?

Question 7. Should there be different levels of credit for different classes of resources?

Question 8. What should the States' roles be in determining what resources are assigned to what tiers and how much credit each should receive?

Question 9. Should improvements to transmission constraints and new storage facilities, like compressed wind facilities, also be credited under a National Power Generation Diversity Standard if they result in more efficient use of energy? Similarly, should demand-side management gains and other efficiency and conservation efforts be credited?

Question 10. Under a traditional RPS, a supplier might be obliged to purchase renewable credits from the Secretary of Energy to meet his obligation if he could not generate the requirement or if found that buying it cost more than buying a credit from the Secretary.

What if instead of spending the money on purchasing credits from the Government, which does nothing to increase diversity, the supplier was credited with meeting that obligation through investments in developing new diverse resources that equal the amount of money he would have paid the Government? In other words, should a retail supplier be able to receive credit for investments in renewable or other eligible resources?

Question 11. If there was a National Power Generation Diversity Standard with requirements of up to 10% diverse resources, how important would tax credits still be to a project's finance-ability?

QUESTIONS FROM SENATOR CRAIG

Question 1. Do you see the need for the federal government to take an active role to bring demonstrated technologies—such as Iogen's cellulose ethanol production technology—out of the “valley of death” where they are languishing because commercial lenders will not finance the first-of-a-kind technologies? If so, do you think that loan guarantees could be a useful part of this strategy?

Question 2. Our farmers produce quite a bit of wheat straw, corn stover and barley straw, rice straw and rice hulls as agricultural waste products. United States biotechnology companies are developing enzymes (cellulases) that will convert those waste products to energy and other products. What programs has DOE undertaken to help these companies move these biotech ethanol production processes forward? What has DOE done to help speed the development of cellulase enzymes to convert wheat straw to bioethanol?

Question 3. We have solved many of the technical problems in using biotech enzymes to convert crop residues to bioethanol. The big remaining problem is the cost of constructing commercial scale biorefineries. How is DOE going to help our companies build these first generation biorefineries in the U.S.? What type of loan guarantees or financing mechanisms can DOE provide?

Question 4. The New York Times has reported that Vice President Cheney is supporting clean energy production methods that use enzymes to convert waste products to energy. In the past, President Clinton had signed an Executive Order to begin a biobased products and bioenergy initiative. What will the Bush Administration do under your leadership to build on these efforts to help us develop a carbohydrate-based economy?

Question 5. The USDA and DOE have been required by the Lugar/Udall legislation to set up a Technical Advisory Committee made up of industry people to advise these agencies on advanced biomass conversion technologies. This biomass advisory committee has been in existence for few years. What kind of work product has it produced? Has DOE and USDA implemented the recommendations of this citizen's advisory panel?

Question 6. The president has focused a great deal of effort on the hydrogen initiative. Has that effort come at the expense of bioethanol energy technologies? Is it possible that since bioethanol is a source of hydrogen it should be included in the national hydrogen initiative?

QUESTIONS FROM SENATOR TALENT

Question 1. If we mandate a national renewable portfolio standard, how would the transmission needed to get wind from remote locations, onshore or offshore, to load centers be paid for?

Question 2. How should nuclear energy and clean coal through coal gasification be factored into a national renewable portfolio standard?

Question 3. We heard testimony from Mr. Brian O'Shaughnessy, CEO of Revere Copper Products, as to the potentially extraordinary cost of adding wind generation (additional transmission, three times the capacity requirements to meet the sales requirements, plus balancing and load following costs), particularly in areas of the country with low wind speeds. To what extent should the cost of adding renewable resources as compared to other resources, be factored in to any renewables requirement? Should economic dispatch of more efficient generating units also play a role?

Question 4. Would it be more appropriate to apply any national renewable portfolio standard requirements only on generation needed to meet load growth?

QUESTIONS FROM SENATOR BUNNING

Question 1. Kentucky does not have many sources of renewable energy. It would be very difficult to put a wind turbine or solar panels in the state and obtain sufficient amounts of energy from them. Since many states are in the same boat as Kentucky, how would a national RPS affect ratepayers in states with low amounts of renewable energy? What would a company in a low renewable state have to do in order to comply with a national RPS as the one suggested in last Congress' energy bill?

Question 2. What possible negative effects, if any, would adding clean coal as a qualifying energy in a national RPS have on utilities and ratepayers?

Question 3. Would the Administration continue to oppose a national RPS if other types of energy sources such as coal and nuclear were added as qualifying energy?

QUESTION FROM SENATOR SALAZAR

Question 1. Assistant Secretary Garman, reducing electrical transmission losses over long distances would mean an increase in energy efficiency, and could result in significant energy savings. Could you comment on how combining renewable energy sources with a distributed generation system would positively benefit rural areas?

